MACHINE DESIGN

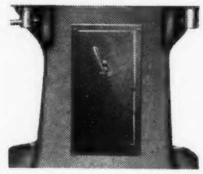
October 1942

Materials Directory Issue

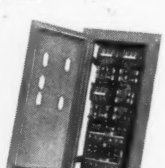
TO THE MAN IN CHARGE OF MIRACLES

UNITROL is primarily a means of mounting skeleton starters. Here is shown the *basic* UNITROL mounting frame, which simplifies machine design and construction.

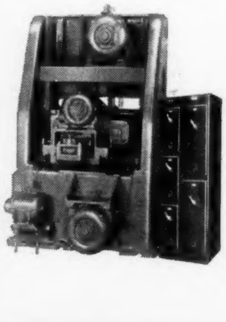
Here a skeleton starter is mounted in place in UNITROL frame. Has its own door, with or without front-operating pushbuttons, etc.



Built-in control!—Through the simple expedient of UNITROL, a cavity cut in base of a machine, and four corner holding screws are all that's necessary.



You can do all sorts of things with UNITROL—for example, mounting 6 control elements in one frame; door pierced for front operation; the entire unit ready for easy installation.



Where a number of motors and controls must be accommodated, UNITROL *builds up* into a compact, space-saving, elastic and complete *section*—set beside the machine it serves.

Here's help in designing and building Motorized Machines

Despite the astounding production achieved by American Industry, more miracles are needed. Minutes gained here, space saved there, materials *not* used somewhere else, facilities and men freed for other purposes, when multiplied hundreds and thousands of times will bring the result we so sorely need.

Take the design and manufacture of motorized machines for instance. UNITROL, the new and better way of mounting, housing and installing Motor Control, helps all along the way. Its standardized predetermined dimensions facilitate design. Its self-mounting frame requires no interior base. It provides its own closure. It simplifies mounting and installation. You need do no machining around the closure. You complete your wiring before you slap UNITROL into place. You save in machine bulk. These and many other marked economies in material, time, manpower, and space *add up to important gains.*

Why don't you investigate UNITROL further . . . *now?* Simply write for the completely descriptive brochure "UNITROL . . . The Next Step Forward in Motor Control." It's free. CUTLER-HAMMER, Inc., 1310 St. Paul Ave., Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ont.

CUTLER·HAMMER
UNITROL
C·H

1892-1942 50th Anniversary

MACHINE DESIGN

THE PROFESSIONAL JOURNAL OF CHIEF ENGINEERS AND DESIGNERS

Volume 14 OCTOBER, 1942 Number 10

Contents

For Itemized Table of Contents See Page 5

MAIN OFFICE: The Penton Publishing Co., Penton Bldg., Cleveland, O.

BRANCH OFFICES: *New York,* 110 East 42nd St.; *Chicago,* 520 N. Michigan Ave.; *Pittsburgh,* Koppers Bldg.; *Detroit,* 6560 Cass Ave.; *Washington,* National Press Bldg.; *Los Angeles,* 130 North New Hampshire Ave.; *London,* 2 Caxton St., Westminster, S.W.1.

PUBLISHED BY The Penton Publishing Co. E. L. Shaner, Pres. and Treas.; G. O. Hays, Vice Pres.; F. G. Steinebach, Secy. Published on seventh of month. Subscription in U.S. and possessions, Canada, Cuba, Mexico, Central and South America: Two years, $10; one year, $6. Single copies, 50 cents. Other countries: Two years, $14; one year, $8. Acceptance under act of June 5, 1934, authorized July 20, 1934.

Itemized Index

Classified for Convenience when Studying Specific Design Problems

MACHINE DESIGN is indexed in Industrial Arts Index and Engineering Index Service, both available in libraries generally.


SYLPHON BELLOWS
Help Save Lives
ESSENTIAL in the operation of the H-H Inhalator—a widely-accepted life-saving instrument supplying oxygen-carbon dioxide to the lungs of persons overcome by gas asphyxia, drowning, etc.—is the Sylphon Bellows, employed as an expansible pressure chamber in the reducing valve of the apparatus.
As a vital link in the dependable performance of this H-H Inhalator, manufactured by Mine Safety Appliances Co., Pittsburgh, Pa., the Sylphon Bellows renders trouble-free service with long operating life. Write for the engineering facts on how Sylphon Controls can serve your applications. Ask for Bulletin TC-130.
E
Proudly we fly the All-Navy "E" flag awarded for excellence and proficiency in the production of Naval Materials.
THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

FOR INDUSTRY AT WAR---

to **WALLACE BARNES CO., 93 Main St., Bristol, Conn.**
DIVISION OF ASSOCIATED SPRING CORPORATION

Please send the Mainspring regularly to:

NAME ____________________

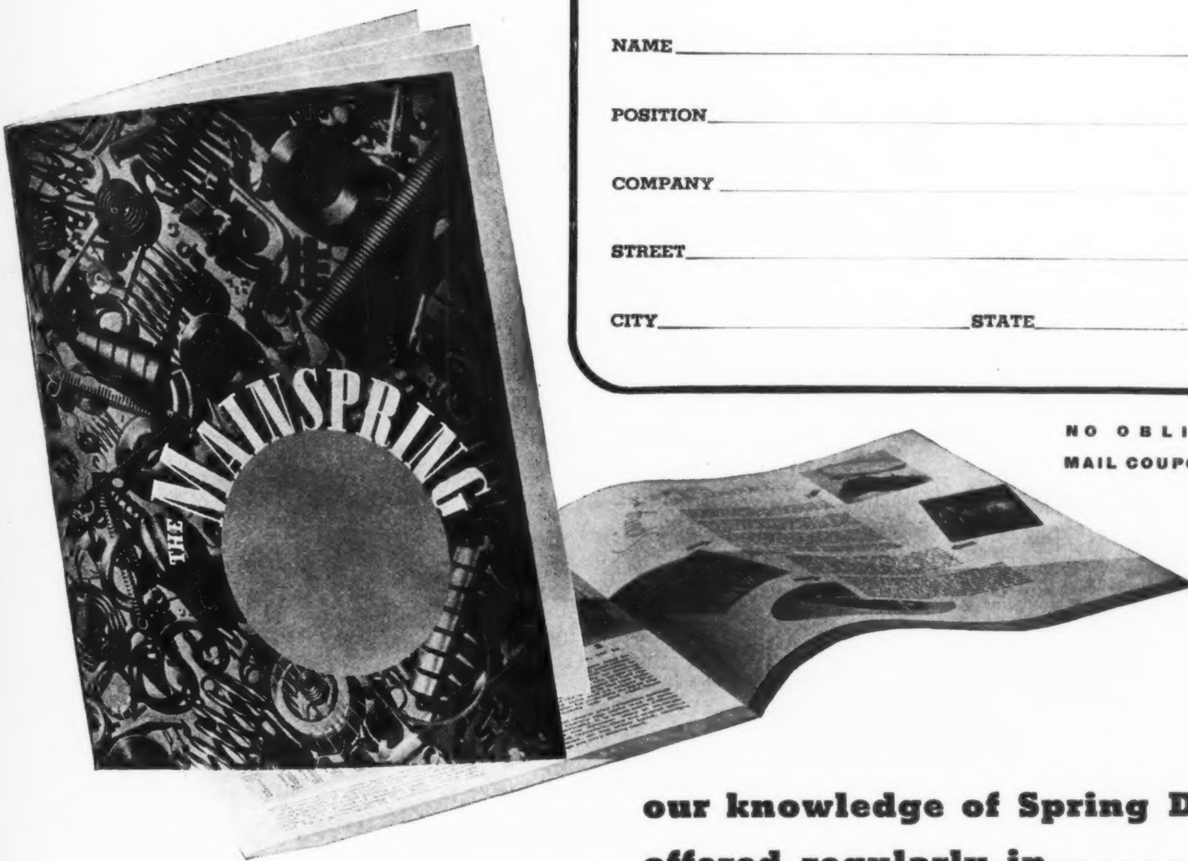
POSITION ____________________

COMPANY ____________________

STREET ____________________

CITY ____________ STATE ____________

NO OBLIGATION
MAIL COUPON TODAY!



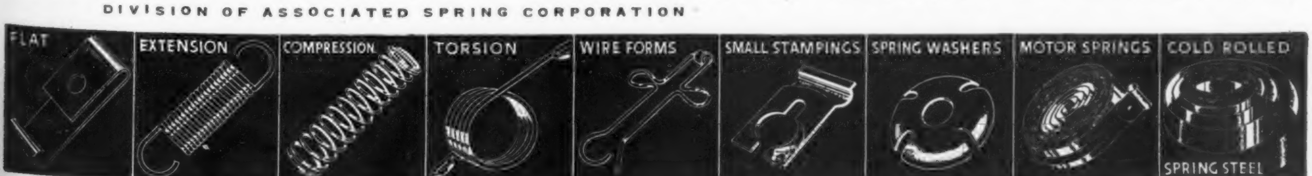
our knowledge of Spring Design offered regularly in - - - - - - - - - - -

THE MAINSPRING

The *Mainspring*, published continuously since 1927, discusses the various types of springs, and spring materials, gives helpful information, practical design charts and formulas. Already popular with its regular readers, this periodical is now offered to those persons whose new duties involve the specification or application of springs to new products or developments. Much of the material has never before been presented in such practical, easy-to-use form. The *Mainspring* is issued six times a year and is sent free to those interested. Use the form shown here; the latest issue will be sent promptly.

For more than three-quarters of a century Barnes-made springs have been specified wherever the importance and economy of good design and careful manufacture have been recognized.

WALLACE BARNES COMPANY, *Bristol Connecticut*
DIVISION OF ASSOCIATED SPRING CORPORATION



SPRINGMAKERS FOR MORE THAN THREE QUARTERS OF A CENTURY

Topics

OF the 84 graduates from a three-month course in introductory engineering at the war industries training school of Stevens Institute of Technology, 34 are women. Interesting are the comparative charts of their abilities: Women have greater clerical speed and in general are better at deductions and abstract reasoning. This leads to the belief that they are better in computation than in drafting work. Men are superior in knowledge of physics, in mathematics and in space sense.

♦

WAR Materials Inc., a recently established government agency, is attempting the task of finding 5,000,000 tons of scrap within the next four months and placing it at the disposal of steel plants. In cases where the cost of collection is more than market value, the agency will be able to pay the added costs. At the same time it will adhere to ceiling prices in payment to owners and in charges to mills. Headquarters are at Ninth and Liberty avenues, Pittsburgh, and branch offices are being established in various cities. Anyone having knowledge of the location of potential scrap will be doing a service by passing on the information to the proper officials.

♦

SAPPHIRES, long the bearings used in delicate instruments, are being replaced by hot-formed, high-alumina glass. According to General Electric engineers there is little difference between the glass and imported sapphires for bearings in electrical indicating instruments.

♦

PLASTIC playwood is finding such widespread uses in war equipment that if production were tripled it would be gobbled up by essential industries. Among the spectacular applications are gliders, torpedo boats, pontoons, mine sweepers and army landing boats.

♦

TYPICAL of manufacturers' services of today and their feelings of responsibility and cooperation in the war program is a publication of the Cincinnati Milling Machine Co. giving complete data for the lubrication of their machines in use, that maximum service might be obtained. Also typical is a recent movie produced by Warner and Swasey Co. for lathe operators to help them tool properly for obtaining maximum production.

♦

IN the many Westinghouse plants, all engaged in war work, handling surplus stocks of critical materials presents a problem to assure that these materials are scheduled properly for production. To do this each plant keeps a list of materials which cannot be used in the immediate future. These lists are combined and mailed to all divisions so that in effect the stock of one plant is available to all. Movement of millions of pounds of steel and other critical items within the company alone has been a direct result. In addition, the bulletins are distributed to outside sources such as Army and Navy procurement agencies, arsenals and ordnance plants, WPB offices and manufacturers working on war contracts.

♦

NEW formulations of ethyl cellulose designed to replace rubber are being used in gun covers, tubing, impregnated fabrics, etc. Using about half plasticizer, this plastic has many of the qualities of rubber, according to the Hercules Powder Co. Toughness, pliability, flexibility, impermeability and thermoplasticity are obtained. Although it retains good flexibility at −70 degrees Fahr., limited elasticity and relatively low resistance to tearing restrict its applications.

♦

PRODUCTION of machine tools has reached a rate of more than $1,360,000,000 a year, according to WPB July figures. Present rate represents an increase of more than 76 per cent over last year's production.

♦

TO promote the use of compressed air in industry, the Compressed Air institute conducted a prize contest for which the winners have been announced recently. Awards were for various applications including methods for increasing production of cartridge cases by 500 per cent, for freeing water of iron, for rapidly laying a mat of asphalt, and for breaking circuits in high voltage lines.

♦

PULP treated with a new permeation product, Plastipreg, is said to gain such strength that it may compete with plastics. Treated in solution without pressure or vacuum, porous materials such as paper, wood or clay are penetrated, driving out moisture and air.

♦

TO help solve technical problems, professional men engaged in war work have urgent need for hundreds of technical assistants as well as junior physicists. In view of the scarcity of qualified persons to fill such positions, the Civil Service Commission has issued its continuously open examinations in revised form. Announcements and application forms are available at any first or second-class post office or from the commission in Washington.

Designing Versatile Press for Powder Metal Parts

By James J. Kux
Kux Machine Co.

GROWING war requirements of the powder metal and ceramic industries have emphasized the need for automatic presses for forming complicated and odd-shaped parts. To meet this need the tablet press illustrated in *Fig.* 1 has been developed, embodying design features necessary for the production of parts which heretofore could not be made on this type of machine.

Odd-shaped bearings, cams, metal filters, component fuse parts, airplane instrument parts, are a few examples of pieces produced from powder iron, bronze, aluminum, etc. Ceramic parts having complicated cored holes, various sectional thickness, protruding lugs or countersunk sections, such as radio tube bases, insulators and coil forms, are produced automatically at speeds up to 25 a minute.

In designing this machine difficult problems were presented because the machine not only must develop neces-

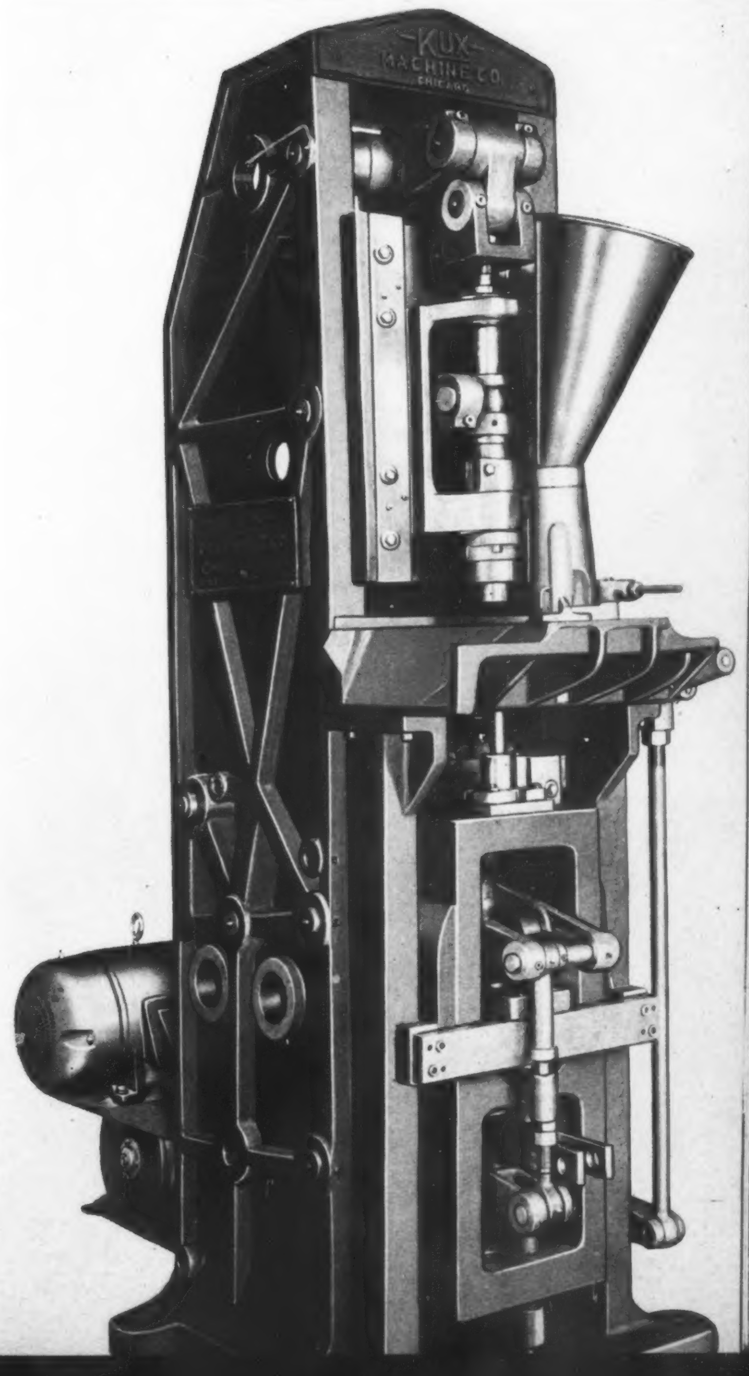


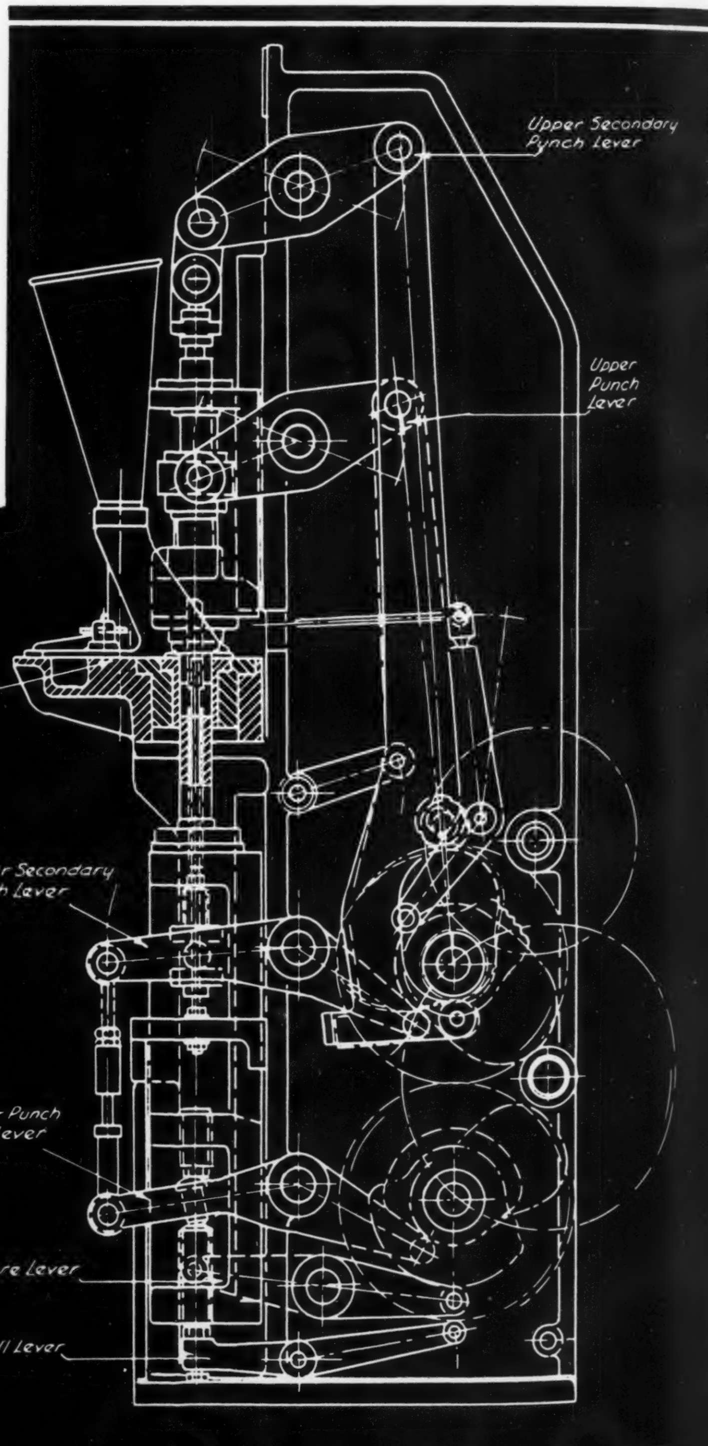
Fig. 1—Highly flexible and automatic, tablet press forms variety of complicated parts

sary pressure, core pulling and ejection motions but also must be flexible in the adjustment and timing of these motions. Any lack of flexibility limits the variety of parts that can be made.

To illustrate the functions of the various mechanisms a brief discussion of the operations follows: Actuated through a link and cam, a feeding shoe is utilized for charging the die with powder material. This shoe, on returning to position out of way of the upper plunger, wipes excess material from the die surface and leaves an accurately measured charge. Forming the bottom of the die cavity are two punches, one telescoped inside the other, as shown in *Fig. 2*. Individually mounted, the main punch carrier operates in V-gibs and the secondary punch in a tubular spindle mounting as shown in *Fig. 3*. Both of these punches control the amount of the material filled into the die, application of pressure to the material and ejection of the finished tablet.

Upper telescoping punches have the main punch body mounted to a carrier operating in V-gibs and the secondary punch mounted by a link connection to its operating lever. These apply an initial pressure to the powder material and come to a positive stop. The lower punches immediately travel upward a predetermined distance, applying pressure to the bottom of the part being formed. At the last portion of their stroke, the upper punches travel downward again imparting an additional final squeeze pressure to the now solid mass. At this point both upper and lower punches dwell, holding the formed piece under pressure so that it has a chance to set, with resulting uniformity of density. After the upper punches have traveled up and out of the die cavity the lower punches, timed slightly behind, also move upward and eject the formed piece from the die cavity. The feeding shoe immediately moves to sweep the finished piece off the die table and refill the cavity with another charge.

Use of multiple, telescoping upper and lower punches permits the making of complicated shapes with varying sectional thicknesses, protruding lugs or countersinks. Each individual punch is operated and controlled independently and thus can be adjusted to do its own individual work. As illustrated in *Fig. 2*, the main lower punch applies pressure to a portion of the bottom of the part being formed. The secondary internal punch provides pressure to the countersunk portion and is adjusted to have a shorter pressure stroke than the outer punch, since the section of the part to which it is applying pressure has less thickness than the overall thickness of the piece. If instead of two punches one lower punch were used to form the part, a fracture would probably occur from the countersunk portion extending across the heavier section, caused by a lack



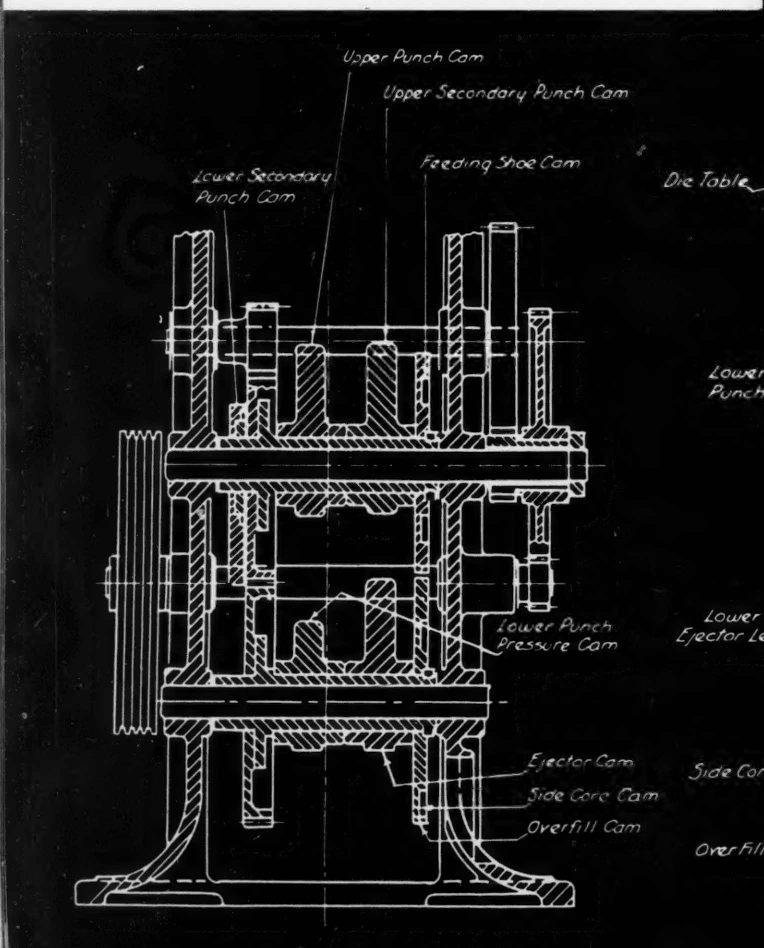


Fig. 2—Upper and lower telescoping punches provide for pressure distribution and irregular shapes

of differentially applied pressure. The two upper punches similarly apply pressure to the top surface of the piece being formed. Their pressure strokes are also individually controlled and adjusted.

Two lower punches are necessary for proper ejection of parts without breaking or cracking them. The outer punch travels up during the ejection period along with the inner punch, both stopping flush with the die surface. The tablet then rests completely on the outer punch, having been pushed up and off the projecting inner punch, and is easily swept off the die table by the action of the feeding shoe.

The illustration, *Fig.* 2, shows a stationary lower core rod which forms the hole in the piece. This rod is securely mounted to a bracket bolted to the main frame directly under the secondary lower punch-holding spindle. Because this stationary core rod often has to withstand considerable pressure a cross bar supporting the bracket is also bolted to the frame.

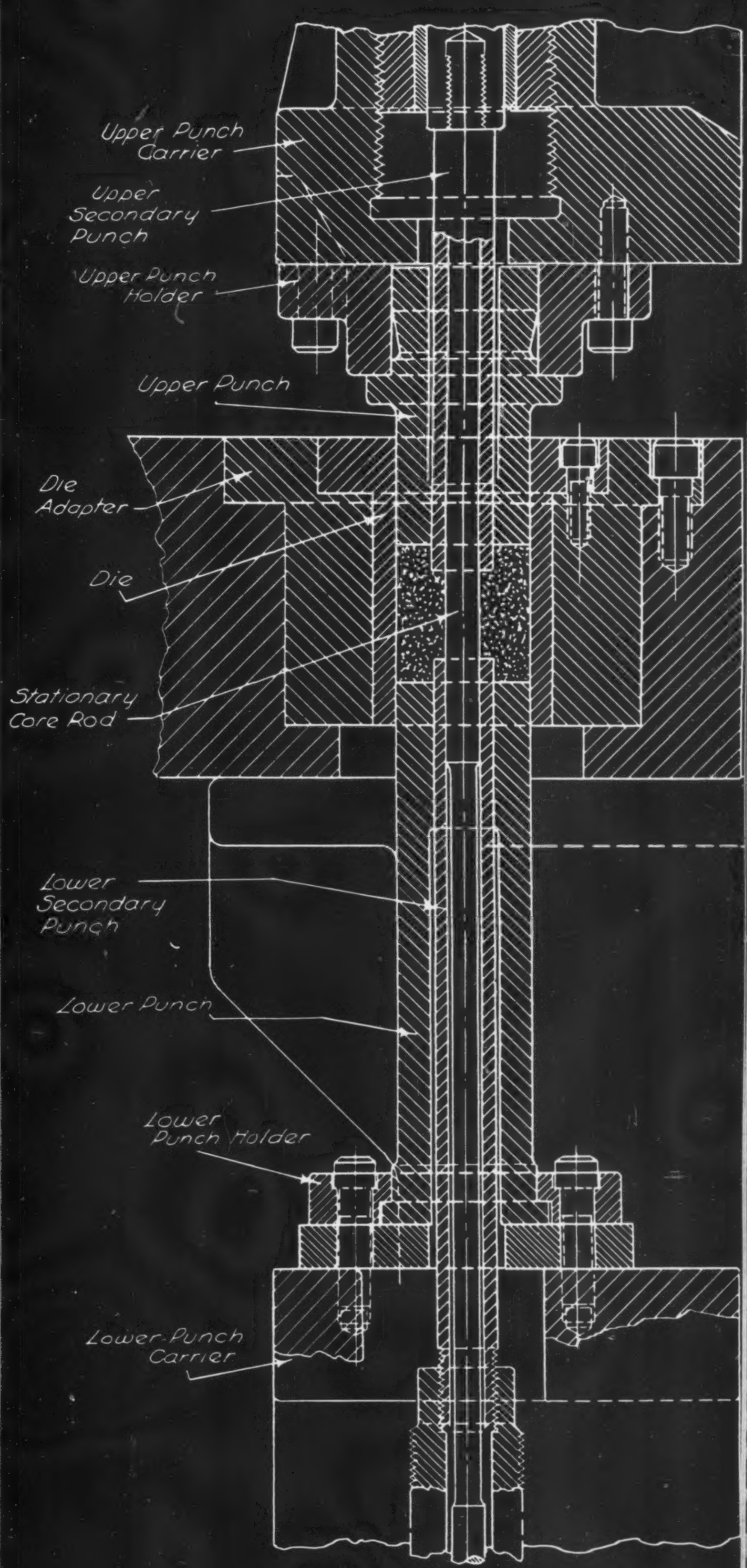
Incorporated in the machine is a side core mechanism operated from its individual cam to form holes or indentations in the side of a part. It is timed so that the core enters the die cavity during the feeding period and then pulls out of the cavity after the part has been made and just before the ejection stroke of the lower punch.

Has Two Camshafts

To gain the necessary individual timing and control over the operating functions of the machine, seven separate bellcrank levers are used, each operated from its own cam. These cams are mounted on two camshafts housed inside a one-piece steel main frame, *Fig.* 3. Triple back gearing is interposed between the flywheel and the camshafts. Each cam has a separate duty to perform and is accurately timed in relationship to the others. All are face cams, except the feeding shoe cam which of necessity is a groove cam, and have replaceable, hardened steel sections bolted on the rises which are subject to the greatest wear, *Fig.* 4.

As previously discussed, the lower main punch is mounted on a steel carrier operating in V-gibs at the front of the machine. The action of this carrier is controlled by three separate levers operating from three cams. The first lever at the extreme bottom of the carrier is an overfill lever for obtaining accurate die fills. Fill adjustment is controlled by a large screw at the bottom of the slide which rests upon this overfill

Fig. 3—Operating linkages for punches and feed shoe motions utilize two camshafts with triple back gearing



lever. Adjustment is always made so that somewhat more than the necessary amount of material is filled into the die cavity by the feeding shoe. Then while the shoe is still over the die cavity the overfill lever rises slightly, lifting the lower punch carrier and thus the lower punch, which pushes the excess amount of powder back into the feeding shoe. The shoe subsequently wipes off the die surface and returns to its original position. This action assures more uniformity of die fills even with poor flowing materials.

Hopper Is Jostled

For facilitating flow of material into the die cavity the feed shoe cam has a series of undulations, timed at the filling position, to jostle the feeding shoe. Light fluffy powders require more shaking than heavier ones and often need, in addition, an agitation device in the material hopper to keep the material flowing through it.

The second and third levers controlling the lower punch carrier are a pressure lever raising the slide during the pressure period and an ejection lever to raise the slide during the ejection period.

Also actuated by an individual lever which contacts adjustable nuts, the stroke of the lower secondary punch is determined by raising or lowering the upper nut which increases or decreases the distance the lever travels through space before contacting the nut. The cam which controls this lever has a unique timing and adjustment for changing the timing of the action of the lever to suit the part being made. Some odd shapes require pressure or ejection action by the secondary punch at a different time in relation to the main punch than normally required. By a few lock bolts the cam can be shifted, in its relationship to the other cams, in 5-degree steps.

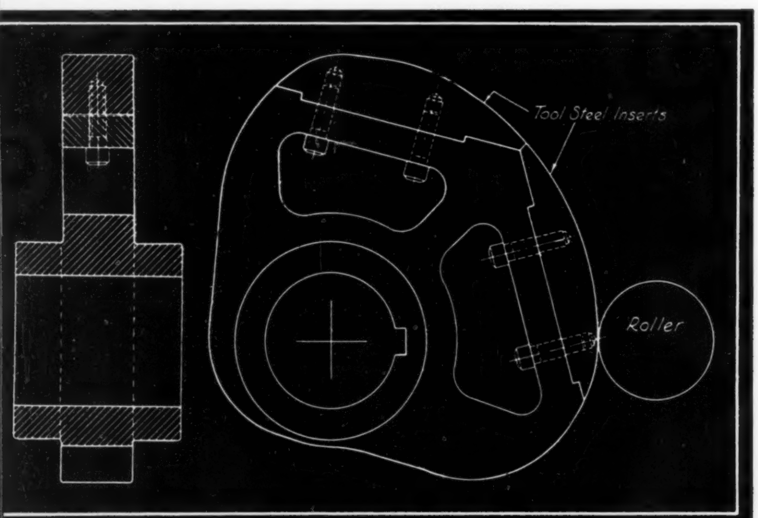


Fig. 4—Cam for upper punch has tool steel inserts replaceable for wear or for changing timing and motion

Upper punch carrier to which the upper main punch is mounted is also controlled by a separate bellcrank lever. This contacts a flanged spool threaded on a large hollow screw extending from the top to the bottom section of the carrier. By turning the flanged spool the carrier and thus the punch is raised or lowered, lengthening or shortening the distance the punch will travel into the die cavity.

Direct-connected to its operating lever by a link mechanism the upper secondary punch also is easily adjusted for length of stroke in the die cavity. Both upper punch bellcrank levers are operated from their individual cams through connecting rods, *Fig.* 3, which have two cam rollers contacting their respective cams. The rods are designed with their lower section curving practically in a semicircle around the cam. One cam roller is mounted at the top of the semicircle and the other at the bottom; thus the two rollers contact the cam about 180 degrees apart. Result of this design is a positive return for the connecting rods and their respective upper punches without the use of springs or other uncertain methods.

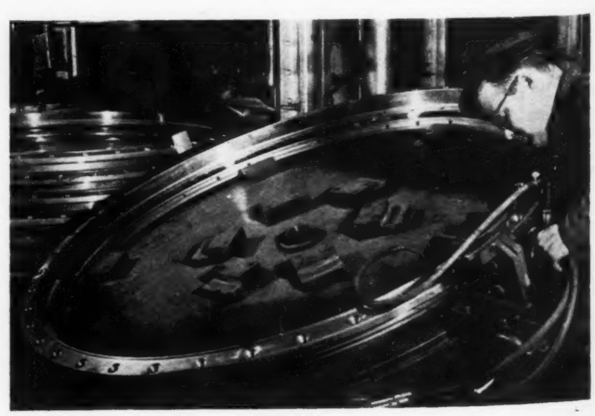
The one-piece main frame is fabricated from two steel castings welded together with cross plates and bars. Designed originally as a one-piece casting, lack of available foundries in a position to handle large intricate castings made necessary the change to two side frame castings.

Because of the high pressures the machine is required to withstand, heavy steel castings are employed throughout for operating mechanisms. Parts subject to wear and strains such as shafts, cams, rollers, pins, etc., are alloy steels heat treated for greater resistance to wear. All of the operating levers have hardened steel inserts at the points where they contact the mechanisms they are operating. These inserts are all removable in case of wear.

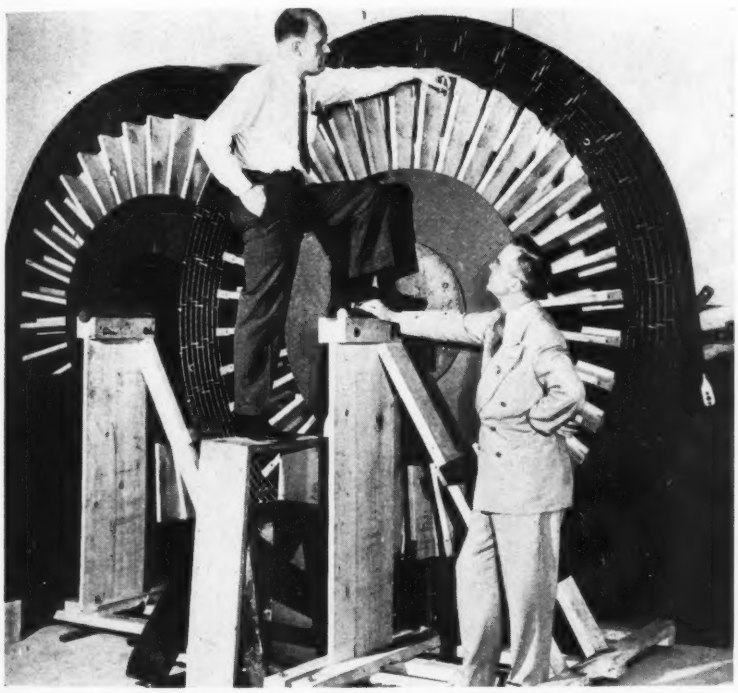
Extension of the main frame, *Fig.* 3, for supporting the die table is a notable design feature. With this method of mounting, pressures applied within the die are absorbed entirely by the main frame.

Tank Part Is Flame Hardened

AUTOMATIC flame-hardening operations for localized heat treatment of bearing surfaces on tank turret rings provides high-speed production necessary for war machines. As shown, the ring revolves past the stationary hardening unit in the foreground. The turntable is tilted to facilitate disposal of the quenching water following the oxyacetylene heating flames. Designed by Linde Air Products Co., the unit requires only a fractional horsepower motor.



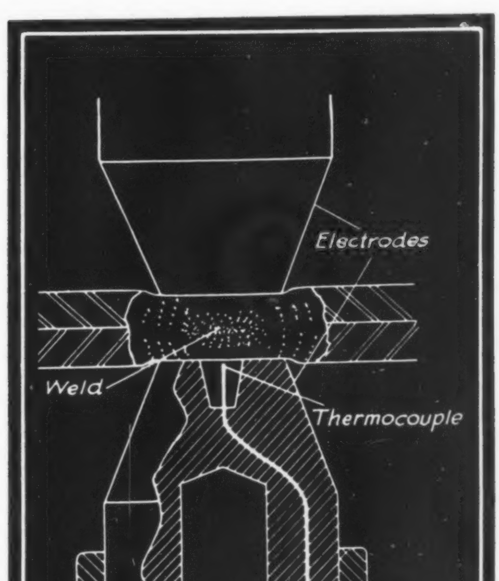
Scanning the Field for IDEAS



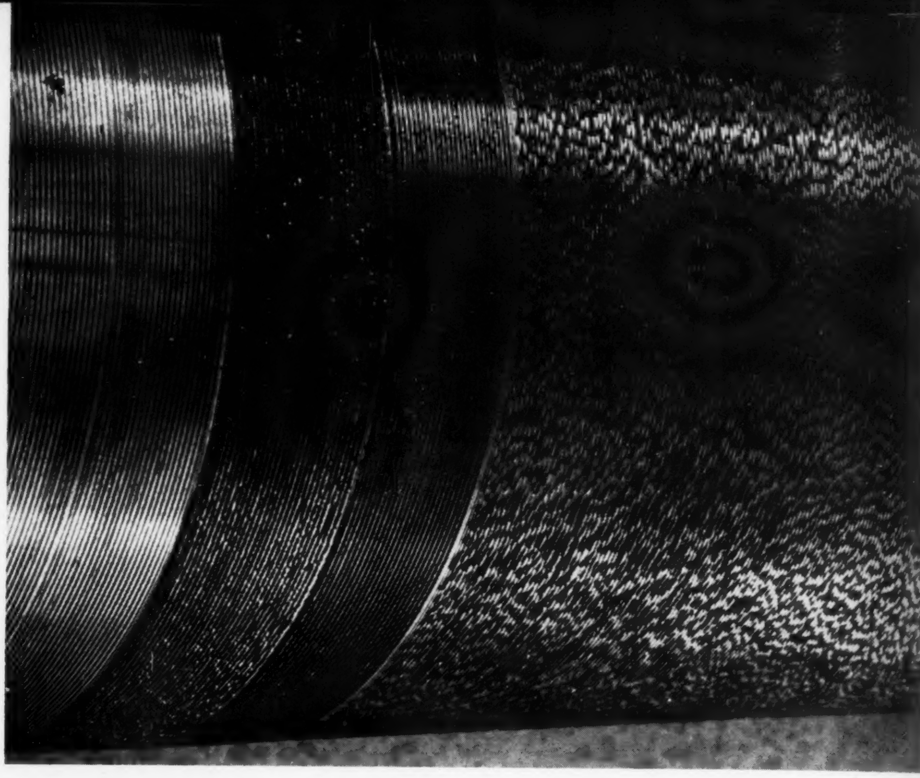
Limitations of radiographic examination of thick armor plate and castings will be explored by G.E. with the aid of an induction electron accelerator capable of developing 100,000,000 volts and of producing X-rays of the same voltage. Shown above are the two large coils which will be used in the machine to develop electron energy far higher than has ever been produced by man. X-ray units of even one million volts give eight-inch penetration in steel.

Main part of the accelerator will be a 125-ton electromagnet. Because alternating current will be used, the core will be laminated from 100,000 pieces of silicon steel sheets 0.14-inch thick, cemented together. The two coils form the primary and are 98 inches in diameter, each containing one ton of copper. Between the coils will be a hollow glass doughnut in which electrons will speed in a vacuum. This will serve as the secondary instead of the usual coil in a conventional transformer. On striking a target in the vacuum tube, the high energy electrons will generate a beam of highly penetrating X-rays. These will emerge from the machine together with scattered high-speed electrons.

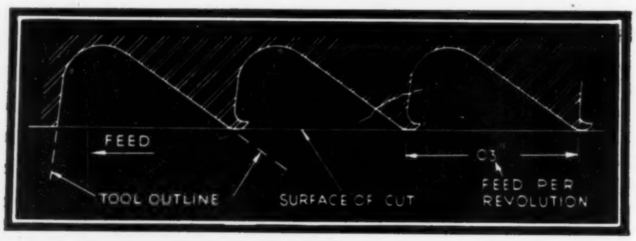
Thermocouple control actually measures the surface temperature of pieces being welded as shown in the sketch, below, of electrodes for a Progressive Welder. In this way the various temperatures required may be controlled throughout the welding cycle. Although the thermocouple does not measure the internal weld temperature, for a given section, the temperature gradient from weld nugget to the surface is constant so that the surface temperature is closely related. In fact small variations in thickness have no measurable effect on temperature measurement. The thermocouple is

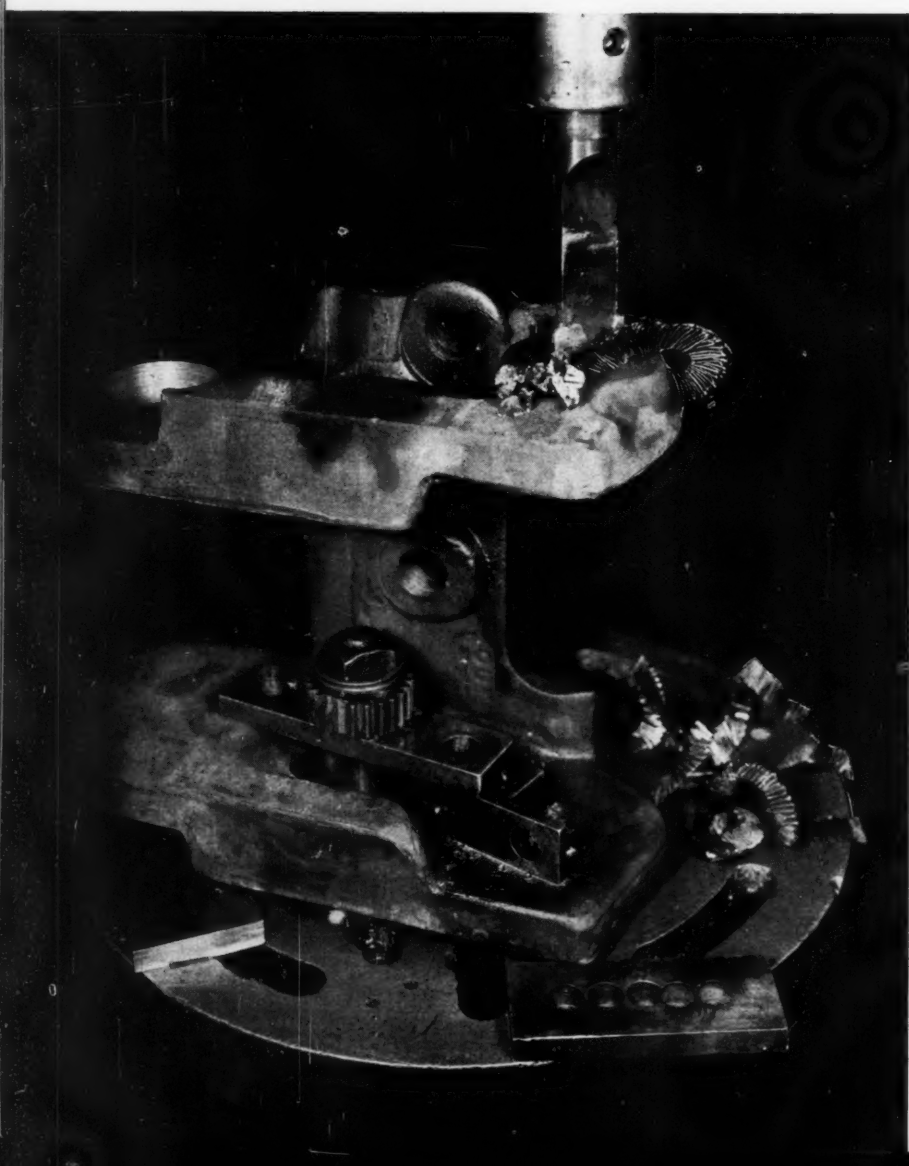


so designed that the electrode may be dressed repeatedly without affecting the unit.



Mechanical bonds for metalizing surfaces which do not form a chemical bond with the sprayed metal have usually been difficult and costly to attain. Surface roughening with special tools such as knurling and dovetail tools has been satisfactory on easily machined materials. With hard alloys, however, the problem is different. For these special jobs, Carboloy Co. has developed an unorthodox ground standard tool to crowd the burr left between cuts and either push it over into a horizontal position or lift sections intermittently as indicated in the drawing at left. The result is a mottled surface, highly satisfactory for metalizing as shown at the right in the above photograph.

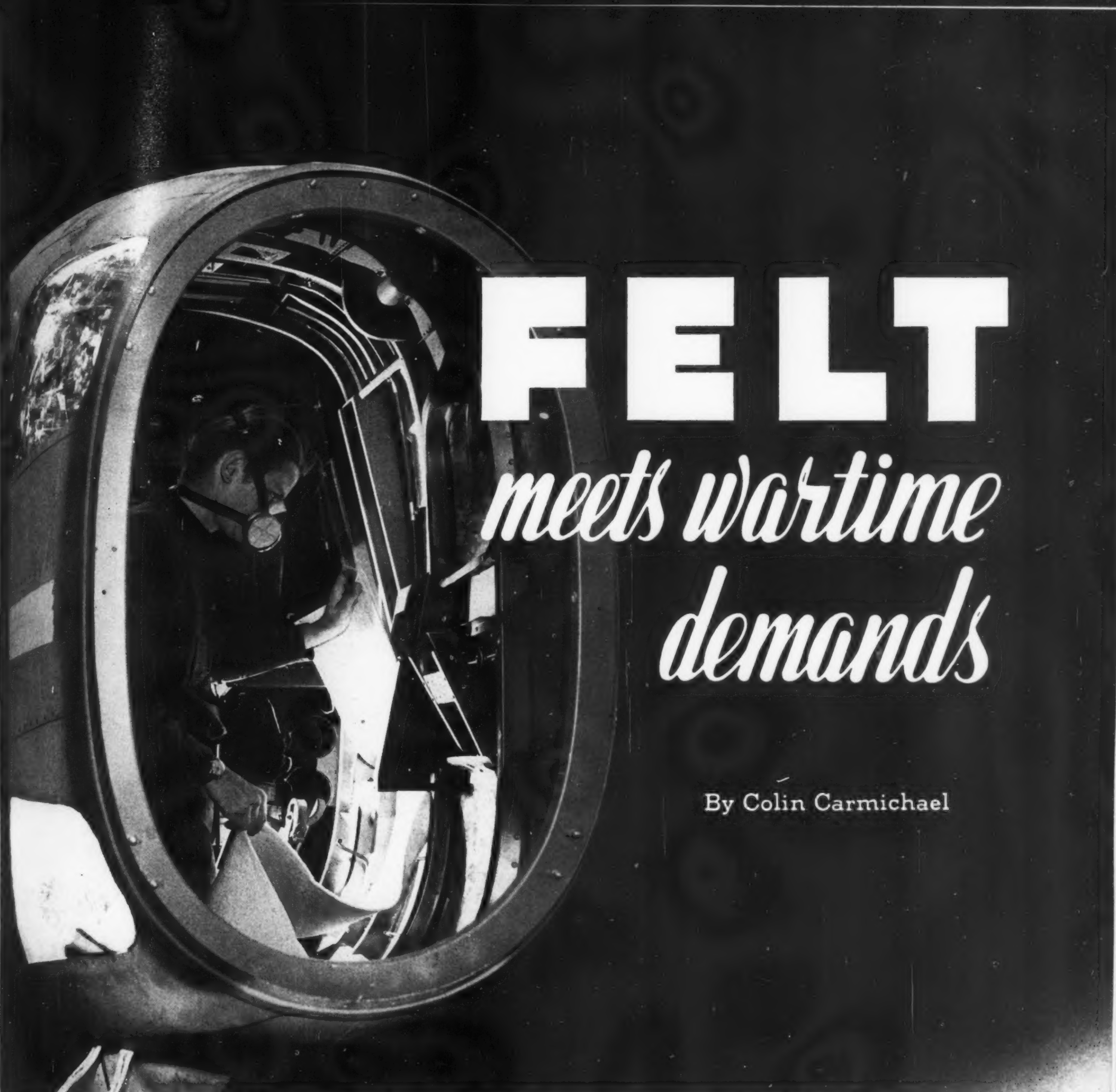




Drilling, reaming and machining hardened steels to obviate distortion from hardening or to correct distortion which has taken place is accomplished with a new alloy tool steel developed by Black Drill Co. Tools of this alloy have high shock resistance and heat resistance, permitting cutting at red heat. Especially useful as a production tool wherever steels hardened to 40 rockwell *C* or higher are involved, it is also effective on armor plate, hard plastics and other hard materials such as amorphous carbon. In the illustration at left, a tool is drilling a tank tread part of alloy steel containing 17 per cent manganese. With production tools of this kind it is possible to design for speedier production as well as to take advantage of salvaging of parts spoiled through distortion.

FELT meets wartime demands

By Colin Carmichael



Photo, courtesy Lockheed Aircraft Corp.

IMPACT of war has greatly accelerated developments in the use of felt as an engineering material. Mechanical applications of current importance in the war program include such diversified services as heat, cold and sound insulation in airplane cabins, *Fig.* 1, vibration isolation of production machines and within army tanks, oil and grease retention in airplane engines, lubrication of production tools and fighting machines with wicks and pads, gasketing, etc. Such a wide range of functions is possible because this type of fabric can be manufactured in an extensive series of grades, under close control, producing definite, preselected combinations of physical properties.

The felt-making process is made possible by the tendency of certain fibers to mat or knit together when subjected to heat, moisture and kneading or beating. Because of its physical structure, wool has the tendency to "mat" to a far greater degree than any other fiber. Viewed under the microscope, wool fibers have the appearance shown in *Fig.* 2. The projecting edges of the fine overlapping scales form serrations which lock the fibers together during the felting process. Other animal fibers such as hair have relatively few serrations while vegetable fibers have

Fig. 1—Temperature insulation for bombers is one of many applications of felt in war machines

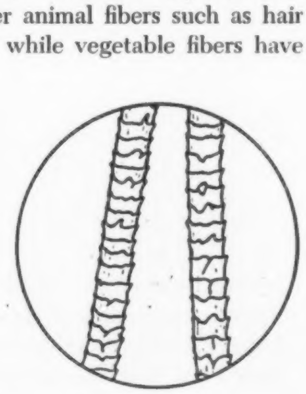


Fig. 2—Wool fibers, due to small scales visible in this enlarged view, interlock during the felting process and produce a strong material

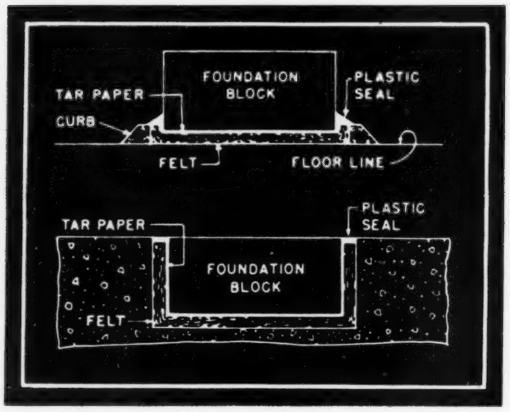


Fig. 3—Foundation blocks for heavy machinery are poured on a felt blanket (upper sketch) or into a felt-lined pit (lower sketch)

none and cannot form felt without the presence of wool.

Close control of the raw materials including the grade and percentage of wool and the duration of the kneading or beating operation provides a wide variety of classifications to accurate dimensions and specifications. By standardizing on relatively few classifications the felt industry has eliminated needless variations, has systematized and increased production, and has eased the task of the designer in his selection. Those of chief industrial importance are listed in Table I, with a few of their outstanding characteristics. Methods of testing felt are standardized by the American Society for Testing Materials.

Examples Show Typical Uses

In general, back check felt is recommended for parts where unusual strength and hardness are needed. It is used for such applications as oil retention when the felt is not compressed, and for washers, bushings, polishing blocks, etc. Extra firm pad felt is particularly resilient and is used for dust shields, wipers, grease retainer washers, wicks, etc. The first three firm pad felts listed (F-10, F-11 and F-12) are recommended for grease and oil retention where the felt is confined and compressed in assembly. Firm pad felts of lower wool content (F-13 and F-15) are suitable for sound deadening and where wear and abrasion are not important factors. Soft pad felt is suitable only as packing or padding when held in place between other materials.

Kapok felt has been specially developed for heat insulation and sound absorption. Composed of approximately 45 per cent kapok fiber, 30 per cent cotton and 25 per cent wool, this material is treated with a flameproof agent which also renders it mothproof. Thermal conductivity is .21 Btu per hour per square foot per degree Fahr. per inch thickness. Moisture absorption is low because of the high percentage of kapok fibers which do not readily absorb moisture. For thermal insulation in the nose section of a Hudson bomber, *Fig.* 1, strips of the pre-cut felt are pressed into place in sections which have previously been sprayed with a special glue.

Sound-absorption coefficients, which measure the fraction of sound energy which disappears at a single reflection from the surface, are given in Table II for several thicknesses and sound frequencies. These figures measure the effectiveness of the material as a lining for a noisy compartment such as the interior of a tank. Like other good sound absorbers, however, the material is not particularly effective in preventing the transmission of sound through a partition.

Ball bearing felts are thin smooth felt used for oil retainer washers, gaskets, liners, etc. Lining felt is recommended for antisqueak strips and for lining when cemented to fiber board or metal panels.

Modification of the physical properties of many of these standard felts is possible by special treatments such as impregnation for flameproofing, moisture resistance, chemical resistance, and increased strength. Significant developments are taking place in the use of felt impregnated with plastics, rubber and synthetic rubbers to give a line of materials having distinctive characteristics. Such materials are being used for special gaskets and washers, vibration insulation, rubber substitutes, etc. While felt is normally supplied as a sheet material, certain wax and resin-impregnated felts can be molded into parts of other shapes. Colloidal graphite impregnation gives a material specially suited for lubrication purposes.

In fighting machines and the machines for their production, felt has countless uses as an aid to effective lubrica-

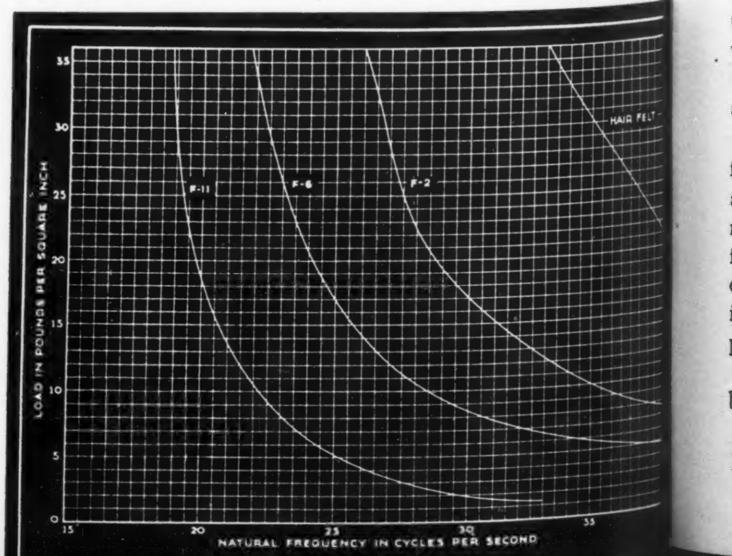
Table I

S.A.E. and Felt Association Standard Felts

S.A.E. No.	Felt Assoc. Designation	Trade Classification	Chemical Analysis % Wool (min.)	Chemical Analysis % Ash (max.)	Spec. Gravity	Breaking Strength (psi)	Oil Absorption† (%)
F-1	B-30	Back Check	95	1.0	.342	500	215
F-2	B-35	Back Check	95	1.5	.342	500	230
F-3	B-40	Back Check	90	1.5	.333	400	190
F-5	C-30, C-35	Extra Firm Pad	95	1.0	.261	400	...
F-6	C-40, C-45	Extra Firm Pad	92	1.5	.261	275	370
F-7	C-50, C-55	Extra Firm Pad	80	2.0	.261	250	290
F-10	D-10	Firm Pad	95	1.0	.182	225	450
F-11	D-20	Firm Pad	92	2.0	.182	200	475
F-12	D-30	Firm Pad	85	2.0	.182	100	500
F-13	D-40	Firm Pad	75	2.5	.182	75	525
F-15	D-50	Firm Pad	55	4.0	.182	75	500
F-26	D-56	Soft Pad	45	5.0	.162	...	625
....	D-70	Kapok	..	...	.085	...	...
F-50	H-10	Ball Bearing	95	1.0	.320	500	225
F-51	G-10	Ball Bearing	92	1.5	.320	300	...
F-55	G-30	Lining	75	3.0	.245	200	...

†Percentage increase in weight when impregnated in oil at 76 degrees Fahr. Values are average for SAE oils 10 to 50.

Fig. 4—Curves aid quick selection and proportioning of felt mountings for vibration isolation. F-11 is suitable for pressures up to 6 pounds per square inch, F-6 from 6 to 12, F-2 from 12 to 25, and the hair felt above 25



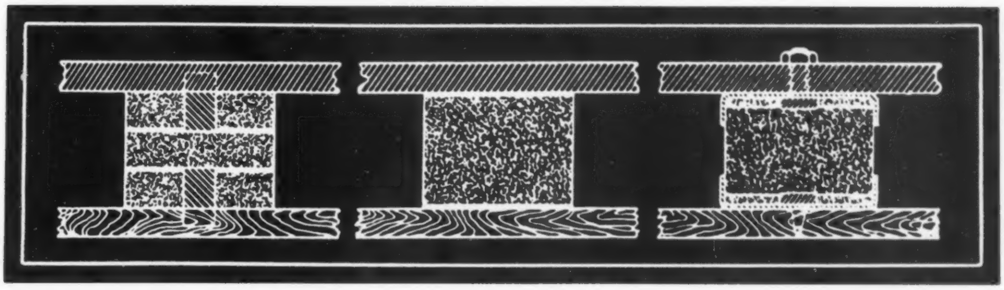


Fig. 5—Felt mounting pads are designed to prevent sidewise motion of the machine yet permit rapid re-location to suit changes in production routine

tion. As wicking it delivers oil at a controlled rate to bearing surfaces by virtue of the attraction of the fibers or filaments for the liquid particles of the oil. If used as a saturated reservoir at the lubricating point a low-density felt that will hold a large amount of oil is best, while for delivery from a remote source a dense felt with greater wicking ability should be used. It is also desirable that felts having a low residual ash content and with medium-to-long fibers be specified to prevent fibers clogging the lubricating point. Density, relative oil-absorbing ability and minimum ash content are listed in Table I.

Table II

Sound Absorption Coefficients of Kapok Felt

Thickness (inches)	Coefficients for various frequencies: 128 (cps†)	256 (cps)	512 (cps)	1024 (cps)	2048 (cps)
3/16	.16	.21	.30	.53	.58
1/4	.17	.24	.40	.65	.74
5/16	.18	.27	.45	.70	.77
3/8	.19	.29	.51	.75	.80
1/2	.20	.31	.62	.81	.83

†Frequencies in cycles per second.

For sealing purposes to prevent escape of lubricant and to exclude dust and moisture from bearings the higher density felts having low oil-absorbing quality are preferred, frequently impregnated with heavy grease or even with rubber or rubber-like synthetics. A closely-allied function is the use of felt as wipers for machine ways, keeping dirt and small chips from the rubbing surfaces.

Versatility of felt is well illustrated by its wide use as filters, for example in industrial instruments where the atmosphere of the plant must have free access to delicate parts of the instrument which would be quickly ruined by dirt. Pneumatic tools which are subject to difficulties due to moisture in the air corroding the parts and even freezing the moving parts rely on felt to cut down the amount of moisture and dirt going into the cylinders and to add oil to the air stream for lubrication and the prevention of corrosion. Feeding devices have been designed to meet unusual cases such as when tools must be operated at various angles.

As a machine mounting for the isolation of vibration felt has marked advantages which have led to its wide adoption for war production equipment. Considerably more compressible than rubber, it does not require freedom for lateral expansion and hence can be used in the form of sheets or pads of relatively large area compared with its thickness, *Fig.* 3, as well as in the more usual form of pads or washers, *Figs.* 5 and 6.

When designing a felt mounting for vibration isolation basic principles of mechanics may be applied in simple fashion. In reducing the force transmitted to the floor or foundation by a periodic disturbing force on the machine, the ratio of amplitudes of the transmitted to the disturbing force—called the transmissibility— is expressed by the equation

$$\epsilon=\frac{1}{r^2-1} \qquad (1)$$

where ϵ is the transmissibility and r is the ratio of the disturbing frequency to the natural frequency of free vibration of the machine upon its support. Inspection of Equation 1 shows that effective isolation (transmissibility less than unity) requires a frequency ratio (r) greater than 1.414. An incorrectly designed mounting in which the frequency ratio is less than this figure may transmit a greater force to the foundation than if the machine were solidly bolted down. In general a frequency ratio between 2 and 3 gives satisfactory isolation, corresponding to a transmissibility from one-third to one-eighth.

Frequency ratio may be conveniently denoted by the relation

$$r=\frac{f}{f_n} \qquad (2)$$

where f is the forced frequency and f_n the natural frequency. Natural frequency of a machine on an elastic support is given by the equation

$$f_n=\frac{1}{2\pi}\sqrt{\frac{kg}{W}}=\frac{1}{2\pi}\sqrt{\frac{g}{s}} \qquad (3)$$

where k is the stiffness or spring rate of the support (pounds per inch deflection), W the weight of the machine (pounds), g the acceleration due to gravity (386 inches per second) and s the static deflection of the support (inches) due to the weight of the machine.

The felt mounting is an elastic material of modulus E

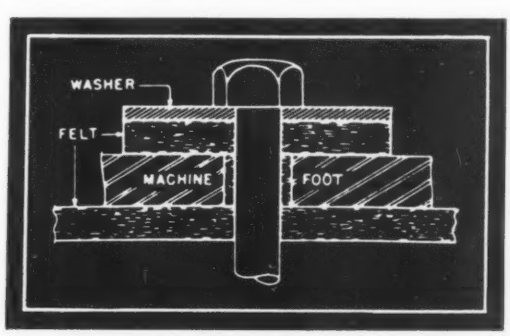


Fig. 6—Felt washer between machine foot and bolt head reduces vibration force transmitted through the bolt

pounds per square inch, area a square inches and thickness t inches, hence the static deflection may be written

$$s=\frac{Wt}{aE}=\frac{pt}{E} \qquad (4)$$

where p is the unit pressure on the felt (pounds per square inch). Substituting this value of s in Equation 3, the equation for natural frequency becomes

$$f_n=\frac{1}{2\pi}\sqrt{\frac{gE}{pt}} \qquad (5)$$

Because the elastic modulus of felt, E, varies with the pressure, p, it is necessary to express this relationship by means of curves, as in *Fig.* 4. Four felt classifications are shown, each type having a different value of E due to different density, and the curves are drawn for a thickness t of one inch. As indicated by Equation 5 the natural frequency is inversely proportional to the square root of the thickness, hence the curves may be corrected for thicknesses other than one inch, using this relationship.

Experience has shown that in designing felt mountings the following rules are helpful in making the initial assumptions:

(1) Small disks under each leg of a machine or at each corner of a flat base are in general more effective than large sheets

(2) Circular disks are better than square, although squares can be used where necessary

(3) Thickness is most frequently one inch, sometimes one half-inch. One and one half-inch pads are occasionally used, these being made of a one-inch pad and a one half-inch pad cemented together

(4) Area of felt isolation required is generally about one-twentieth the area of the base where a flat base is used.

When the disturbing force is small relative to the weight of the machine, felt pads alone are sufficient to hold the machine in place. To counteract any tendency for the machine to walk away the mountings are designed as shown in *Fig.* 5. Center illustration shows the felt pad glued to both foundation and machine with a special adhesive which can be softened with a suitable solvent whenever it becomes necessary to move the machine. Only the adhesive next to the floor need be removed and the pad stays with the machine. Left-hand design uses short studs which protrude part way into the felt but make no metallic contact, while the right-hand design uses retaining metal cups secured to the machine and to the foundation, the cups being shallow enough to prevent metallic contact even with maximum loading.

Designing Supports for Heavy Loads

In cases where large disturbing forces call for anchor bolts to hold the machine down, special care is necessary to prevent the conduction of vibrating forces through the bolts themselves. A suitable design using a combination of felt washers and pads is shown in *Fig.* 6.

For heavy machinery such as drop hammers, punch presses, shears and fulling mills, the entire concrete foundation block under the base is poured on tar paper laid over a felt blanket, *Fig.* 3.

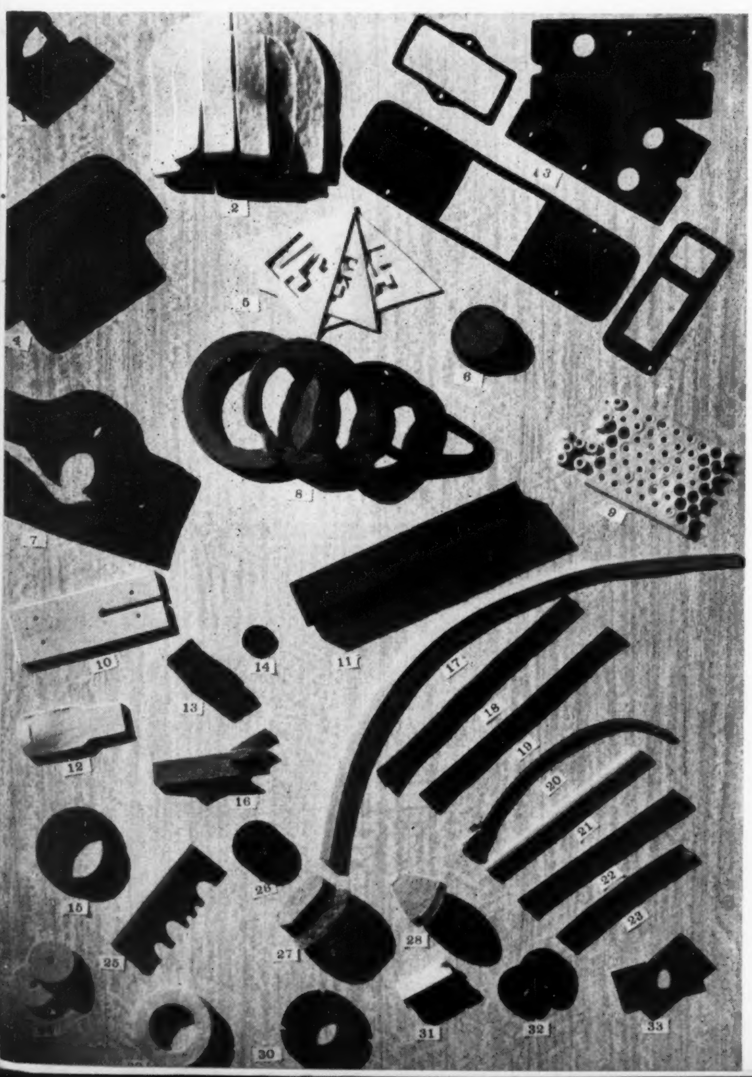
Because effective isolation depends on causing the machine to vibrate in opposite phase to the disturbing force so that its inertia opposes it, damping due to the internal friction of the felt slightly increases the transmissibility. The effect is unimportant, and the small amount of damping that is present aids in quickly disposing of transient vibrations and in preventing the build-up of high amplitudes while running through the critical speed when accelerating or slowing down.

In considering possible uses of felt in machines designers will do well to bear in mind the wide range of possible properties that can be obtained—some felts being hard enough to turn on a lathe, others soft enough to be sewn. Little affected by age it resists deterioration and wear, does not ravel or fray and can be made absorbent or repellent so far as liquids are concerned. Consequently the range of materials for which it is a potential alternative is wide. Intricate shapes of which those shown in *Fig.* 7 are typical are being turned out in quantity through new developments in cutting devices.

While felts with the highest virgin wool content are superior for purposes requiring strength and abrasion resistance, these materials are subject to allocation by the Government. For important civilian uses felt mills are developing special mixes, with lower proportions of wool and using some re-worked wool, which are satisfactory for the purposes for which they are designed.

Co-operation of the following companies in supplying information and illustrations included in this article is acknowledged with appreciation: American Felt Co., *Fig.* 4 and 5; The Booth Felt Co., *Fig.* 2; The Felters Co. Inc.; Western Felt Works. Extensive collaboration of the Felt Association, *Figs.* 1, 3, 6 and 7, was also of great assistance.

Fig. 7—These formed felt parts of varying degrees of hardness were die cut for applications in war machines



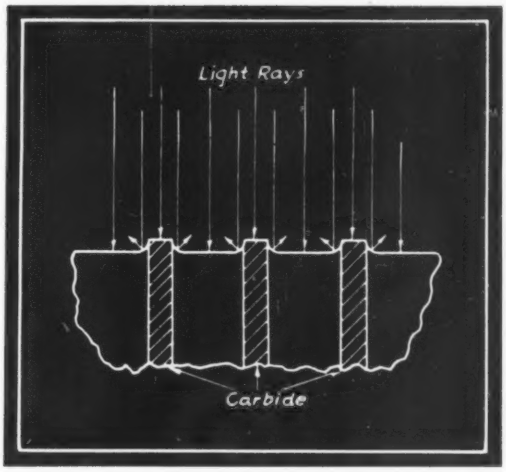


Fig. 18—Cross section of iron carbide plates in ferrite matrix. Light rays are reflected away from microscope at junctions

Wartime Metallurgy Conserves Strategic Materials

Part III—Iron and Carbon

By R. E. Orton and W. F. Carter
Acme Steel Co., Chicago

ESSENTIALLY iron and carbon, steel is hardened, annealed, or otherwise altered by heat treatment which affects the interrelation between these two elements. Alloying elements are added primarily because of their effect on the iron-carbon relation. Consideration therefore will be given in the following to the iron-carbon composition, uncomplicated by any other material.

This method of approach is undeniably theoretical. However, that does not mean it is difficult or complicated. Because it is basic it is the only approach that will permit of the freedom of analysis in the search for substitutions which has become one of the keys to the production success of this war.

Mention should be made in passing to the fact that metallurgy is characterized by a variety of specialized technical terms unfamiliar to the average design engineer. This contributes no small amount to the difficulty of understanding. To minimize this complexity, as few as possible of these terms will be used, resort being made to simplified descriptive expressions. To provide for a clearer understanding of current literature, a glossary of technical terms will be given at the end of the series.

The preceding article covered the crystallography of iron and tied in the variation of the physical properties with alterations in the crystalline structure. It also discussed, in general terms, how some of the alterations might be obtained and described the existence of iron in two allotropic forms, gamma and alpha. The first of these

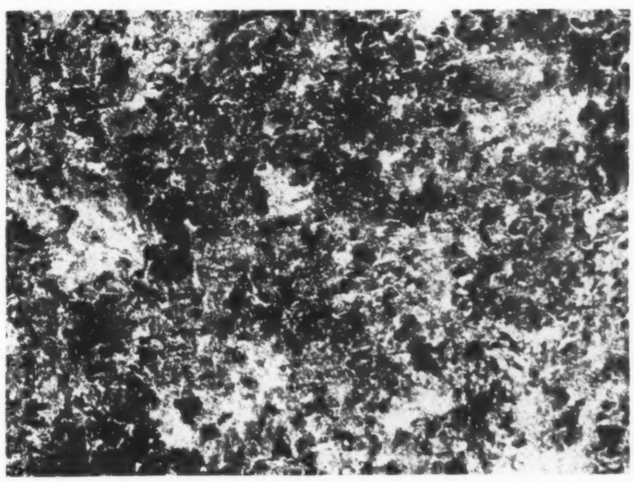


Fig. 19—Pearlitic structure obtained by slow cooling near eutectoid composition. Brinell 207, carbon .7 per cent, magnification 100 diameters

is stable above a certain critical temperature and the second below this temperature. It is important to distinguish between the two allotropic forms when dealing with the addition of carbon to iron.

Gamma iron dissolves carbon up to 1.7 per cent if the temperature is sufficiently high. The solution of carbon in gamma iron has all the characteristics ascribed to solid solutions in the preceding article. In particular, the carbon is in a state of atomic dispersion, tends to diffuse with time to a uniform homogeneity, and is stable. This solid solution is termed "austenite" after Sir Robert Austens.

Alpha iron has practically no solubility whatsoever for carbon. It can hold less than .01 per cent in stable solution at room temperature, and approximately .03 per cent at temperatures near the critical. This amount is so small that, except for a later discussion of "precipitation age hardening" of low carbon steels, alpha iron will be spoken of as having no solubility for carbon.

The condition of carbon in alpha iron is believed to

be the carbide Fe_3C. As such it forms an aggregate with the iron and whatever distribution it may have will be unstable, the tendency being to agglomerate, that is, to gather together into larger and larger masses. At the usual temperatures of use the rigidity of iron is such that this agglomeration may not proceed. The normal microstructure may be expected to consist of the carbide distributed in some fashion through the iron as a matrix. Alpha iron, as such, is distinguished from austenite, and from other constituents to be later described, by the term

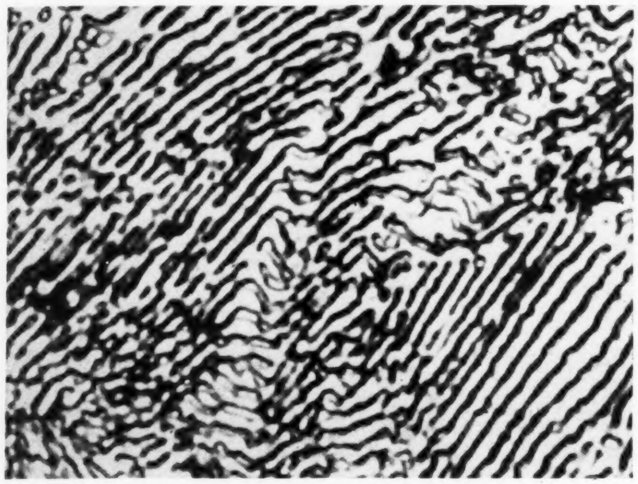
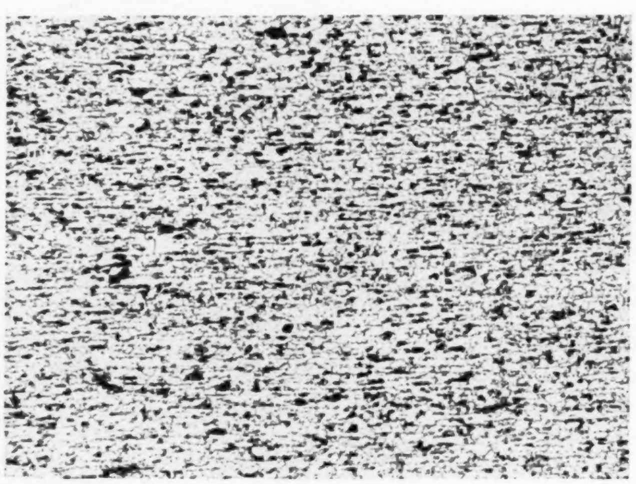


Fig. 20—Structure of pearlite in Fig. 19 at 2000 diameters enlargement, showing the lamellar structure

Fig. 21—Below—Slowly cooled hypoeutectoid steel. Dark patches are pearlite, remainder is free ferrite. Carbon .3 per cent, enlargement 100 diameters



"ferrite". Ferrite, or pure iron, is very soft, having brinell hardness as low as 90 and high ductility. Iron carbide, due to a complex lattice structure, is the hardest constituent of steel with a brinell hardness estimated at over 700 and corresponding brittleness.

Hardness of the aggregate steel is not, however, due to the hardness of the carbide but rather to its interference with slippage along the atomic planes of the ferrite crystals. The method of interference of a foreign body with the lattice structure of the material in which it is entrapped was covered in the preceding article. It is apparent that the hardness of a carbon steel will depend upon the amount of carbon present and the distribution of the carbide formed from that carbon. The first may be said to determine the capacity of the steel for hardness and the second the extent to which that capacity is used. It is this second that is modified by heat treatment.

Nature of the change in the condition of the carbon may be brought out better by considering what happens when the iron transforms from the gamma to the alpha form. If the austenite has been held at temperature for a sufficient time the carbon will have diffused to a uniform and homogeneous solution. As the critical is passed on cooling, the gamma iron changes to alpha and the carbon is precipitated out of solution. It combines at once with some of the iron to form carbide and at this moment will be in a state of molecular dispersion. Whether or not it then agglomerates will depend upon whether or not the iron is at that particular point at a high enough temperature. If it is, the "high temperature" products of the transformation of austenite is formed. If too low, the "low temperature" product is obtained.

Critical temperature of the allotropic change is lowered by the presence of carbon in the austenite solution, just as the presence of salt in water lowers the freezing point. The lowest temperature of transformation is with about .85 per cent carbon. This percentage is known as the "eutectoid", meaning "that combination in an alloy system which gives the lowest freezing point".

Carbide Deposits in Regular Pattern

As the critical temperature, about 1335 degrees, is reached in steel of this composition the iron transforms to the alpha form, precipitating the carbide from solution. At these high temperatures of transformation, carbide molecules are deposited in thin, flat layers distributed through the ferrite matrix. The whole is dispersed in a regular pattern, the plates being of uniform and regular thickness. Within each transformed grain of austenite these plates run in the same direction.

Polishing and etching of a specimen of this structure erodes the softer ferrite, leaving a surface as shown in section in *Fig.* 18. When the surface is examined under the microscope light rays are reflected into the glass from the flat portions of the carbide and ferrite, and scattered at the junctions. At relatively low magnifications the scattering reduces the reflected light to such an extent that the structure appears dark, as in *Fig.* 19. Examined under white light an iridescent pearly appearance is produced, from which the term "pearlite" has been coined to define the structure.

Examined at larger magnifications, as in *Fig.* 20 at two thousand diameters magnification, the lamellar structure may be seen readily. The light portions are both ferrite and carbide, the dark portions being the junctions as illustrated in *Fig.* 18. The carbide lamellae vary widely in width, depending upon the rate of cooling and other variables, but in an average slow-cooled structure they are about 20 millionths of an inch or 2000 alpha lattice spaces. With some etches the carbide itself may be colored, bringing out the lamellar structure forcefully.

As would be expected, pearlite exhibits physical qualities between those of the carbide and ferrite. It is harder

and more brittle than ferrite but not nearly as brittle as carbide. Its properties depend also to a large extent upon the size of the lamellae and grain. Strengths between 100,000 to 125,000 pounds per square inch, elongation 10 to 15 per cent and hardness 200 to 250 brinell, are typical.

Composition of steels having a lesser quantity of carbon is described as "hypoeutectoid," meaning less than the eutectoid, and compositions of greater amounts as "hypereutectoid". The structures of these compositions differ from that obtained with the eutectoid. In slow cooling of a hypoeutectoid steel, the austenite will again cool to a temperature below that for the transformation of pure iron without any change. But, at a temperature higher than that for the transformation of the eutectoid composition, crystals of pure alpha iron (ferrite) precipitate. It is as if the austenite could hold only so much ferrite in solution below a certain temperature. This increases the carbon content of the remaining austenite. With lowering of the temperature beyond this point free ferrite continues to crystallize until the carbon content of the remaining austenite reaches the eutectoid composition, again at 1335 degrees. Here all the remaining austenite changes bodily into pearlite just as described under the eutectoid steel.

In *Fig.* 21 is a photomicrograph of a .3 per cent carbon steel slowly cooled. Pearlitic grains occupy roughly one-third, the remainder being free ferrite. These pearlite grains are no different from the pearlite formed from the eutectoid composition first described. The carbon content is unvarying at approximately .85 per cent. The free ferrite may exist in patches or, with very slow cooling, as a network surrounding pearlite grains. This network structure is obtained from the rejection of the ferrite at the boundary of each austenite grain, the pearlite being left in the center.

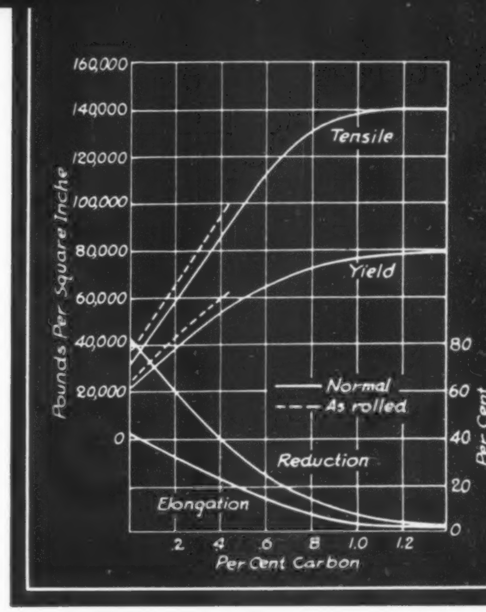


Fig. 22—Variation in physical properties of commercial carbon steels in normal pearlitic condition and in as rolled condition

Fig. 23 — Below — Surface-carburized low-carbon steel showing gradation of carbon content. At (a) is hypereutectoid, (b) eutectoid and (c) hypoeutectoid Magnification 500 diameters

(a)

(b)

(c)

Characteristics Depend Upon Statistical Average

Again, the physicals depend upon the statistical average of the grains and will lie intermediate in qualities between eutectoid steel and pure iron. *Fig.* 22 gives curves showing the characteristics with variation in the carbon content for steels slowly cooled to the "normal pearlitic" structure. These curves represent average qualities to be expected from commercial grades of steel, as rolled. The exact values depend upon the grain size, size of pearlite lamellae, presence and extent of network structure, etc.

Cooling of a hypereutectoid steel is similar to that of the hypoeutectoid except that the carbide is precipitated from the austenite, rather than the ferrite. The precipitation of carbide reduces the carbon composition of the remaining austenite, the process continuing with fall in the temperature until the eutectoid composition is reached. At this temperature the entire remaining austenite transforms bodily into pearlite. The tendency for a network structure will be even stronger than with the hypoeutectoid. Free carbide will be dropped out at the boundary of each austenite grain, the center transforming to pearlite. Since the quantity of free carbide is relatively small, the area occupied by it will be much smaller than is the case in the free ferrite of the .3 per cent carbon steel.

By adding carbon through the surface of a piece of low carbon steel all gradations of carbon content may be observed, as in the photomicrographs of Fig. 23. Physical properties will not change greatly with variation of carbon content in the hypoeutectoid steel because the carbide occupies a small portion of the whole. There will, however, be some increase in hardness and brittleness with increase in the carbon.

The picture as a whole, with any carbon content, is one of the rejection of the excess constituent as the temperature falls until the remaining austenite arrives at the eutectoid composition, whereupon it changes bodily into pearlite. If the carbon content is low, carbonless ferrite is rejected, raising the carbon content of the remaining austenite. If the carbon is high, iron carbide is rejected thereby lowering the carbon content of the remaining austenite.

These structures are not the stable arrangement of the carbide. They are, so to speak, frozen due to the lowering of the temperature to a point where the carbide can no longer migrate through the iron. If the temperature were raised to a much higher level, but still below the critical, the carbide would gradually diffuse through the iron and gather together into large masses. The time required is long, running up to 20 or more hours depending upon the temperature. The masses of carbide gather together into more or less perfect spheres, from which

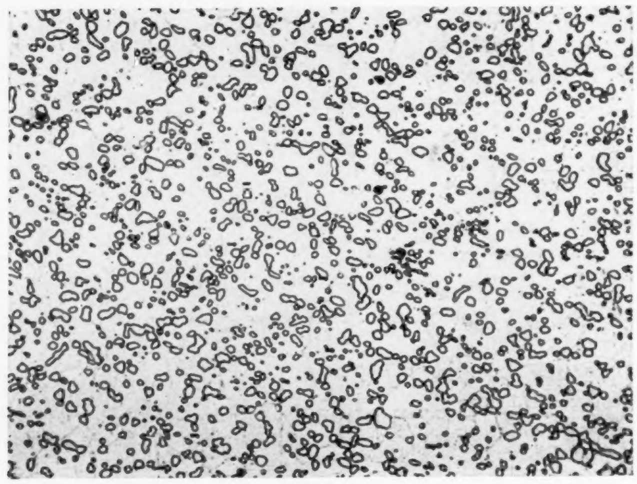


Fig. 24—Spheroidized structure of a steel near the eutectoid composition. Held at 1300 degrees for 30 hours. Brinell 133, carbon .7 per cent, 500 diameters

the term "spheroidized" has been derived for this structure. *Fig.* 24 is typical of the structure obtained by this treatment. This is the softest form of steel for a given carbon content. Under certain circumstances it places steel into a desirable condition for further machining or cold working.

While the temperature at which the pearlite transformation occurs is fixed at 1335 degrees for a slowly cooled steel, that for the beginning of ferrite and carbide precipitation will vary with the carbon content. The plotting of these temperatures against carbon content gives the iron-carbon equilibrium diagram of *Fig.* 25. This shows the constitution of steel at any temperature, provided only that the temperature has been reached slowly. As an example the line indicating a .2 per cent carbon steel has been drawn on the diagram. Above 1525 degrees it is the austenitic solution of carbon in gamma iron. At 1525 degrees the precipitation of ferrite begins. The rejection of the practically carbonless ferrite raises the carbon content of the remaining austenite until, at 1335 degrees, it has the eutectoid composition, .85 per cent. At an intermediate temperature, say 1420 degrees, it will be a mixture of austenite and ferrite. The carbon content of the austenite will be .45 per cent, as indicated on the diagram, and the mixture will consist of .20/.45= 45 per cent austenite, the remainder being the ferrite. At 1335 degrees the remaining austenite, now at the eutectoid composition, transforms to pearlite, the structure then being .20/.85=23.5 per cent pearlite, the remainder being the ferrite which has precipitated from the solution.

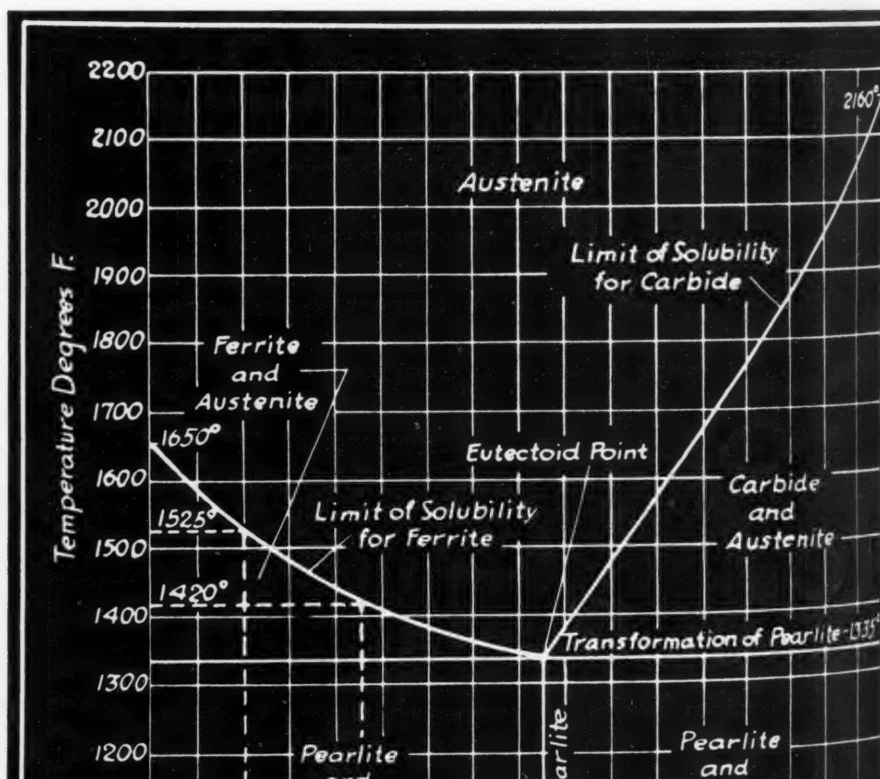
To simplify terminology the line marking the limit of solubility of the ferrite will be termed the "ferritic line." Similarly, the "carbide line" and, at the pearlitic transformation, the "pearlitic line" will be used. The temperatures lying between the ferritic or carbide line and the pearlitic line will be termed the "critical range" or the "critical".

Diagram Is for Ideal Conditions

This illustration is termed the equilibrium diagram because it gives the constitution of steel for an infinitely slow rate of change in the temperature. At more rapid rates the temperature values are shifted, lowered on cooling and raised on heating. This lag or hysteresis means that in practice it is necessary to go somewhat higher in temperature to obtain austenite, and lower to transform back. The heating lag is, however, not nearly so pronounced as the cooling. It should be noted that this diagram holds only for iron and carbon. Addition of nearly any alloy changes the transformation temperatures and the extent of the hysteresis.

It would appear that the transformations do not occur instantaneously. The hysteresis results from the time re-

Fig. 25—Below—Iron-carbon equilibrium diagram shows constitution of steel at any temperature provided no alloying elements are present. This equilibrium exists only for the ideal condition of infinitely slow rate of cooling. Hysteresis retards transformation such that cooling rate has a marked effect



quired to initiate and complete the transformations. The urge to transform will increase, however, as the distance from the equilibrium temperature is increased. In particular is this true of the absorption of the free carbide in hypereutectoid steels with rise in the temperature, the action being very sluggish. On the other hand the excess carbide is quick to fall out of solution on cooling, with the result that the network structure of free carbide is nearly always seen in steels of 1.2 per cent carbon and higher, even on fairly rapid cooling.

Effect of Cooling Rate

The previous discussion has been concerned with fairly slow cooling. With slower cooling, as for example in furnace annealing, a coarse pearlitic structure is obtained in the hypoeutectoid steels, with a pronounced ferritic network. With slow and prolonged cooling, as would be expected, the spheroidized structure of *Fig.* 24 is obtained.

With increase in the cooling rate a finer and finer division of the pearlite lamellae is obtained. Ferrite is present in patches rather than in the network structure

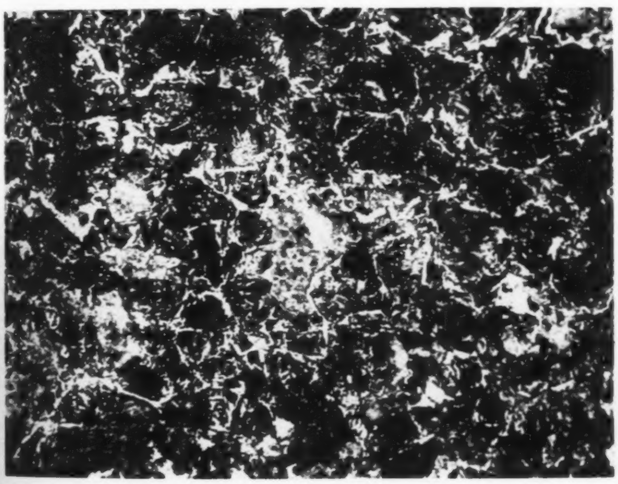


Fig. 26—Fine pearlitic structure obtained by fairly rapid cooling rates. Brinell 220, carbon .7 per cent, magnification 500 diameters

and is even occasionally entrapped in the pearlite. An austenite grain, instead of producing only one pearlite grain, develops several. Strength and hardness is greatly increased, the increase in hardness being accompanied, as usual, by a reduction in ductility. This structure is illustrated by *Fig.* 26.

With still more rapid cooling the lamellae become thinner and thinner. The carbon content of the pearlite in the case of the hypoeutectoid steel is reduced to nearer that of the whole, and the patches of free ferrite become less and less. As quenching rates of cooling are approached the carbide becomes submicroscopic in size, the whole having a uniform emulsified appearance, all free ferrite having now disappeared. This structure, illustrated in *Fig.* 27, has high strength and hardness, the exact value depending upon the carbon content and the state of the emulsification. Values of over 200,000 pounds per square inch, 400 brinell, and surprisingly high values of ductility have been reached.

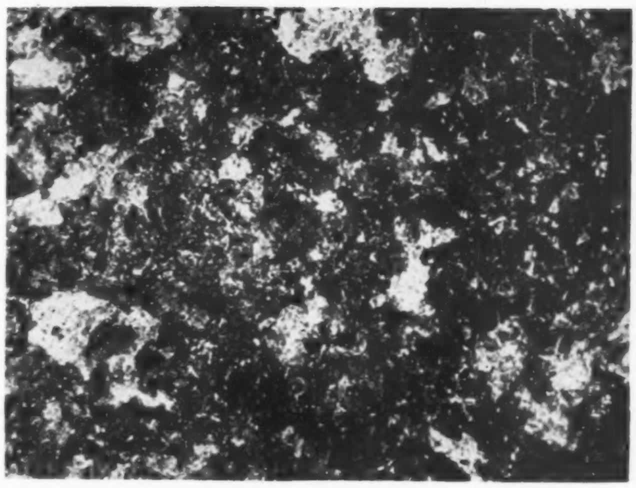


Fig. 27—Emulsified pearlitic structure obtained by cooling rates approaching a quench. Brinell 341, carbon .7 per cent, magnification 500 diameters

Obtaining fully emulsified pearlite by fast rates of cooling, except in the austempering and other specialized processes to be described later, is a "hair trigger" operation and not commercially practical. Instead it is supplanted by the full hardening process which, though more elaborate, is easier to control. The next article of this series will discuss steels quenched to full hardness, and the release of that hardness by the tempering operation.

Harness Facilitates Assembly

HARNESS assembly of conduit-covered wires used in the electrical systems of Flying Fortresses greatly facilitates production by less-skilled hands and aids the highly skilled mechanic during final assembly in the aircraft. Each termination in the plug is numbered to correspond to the number of the wire and a certain series of wires is attached to the plug before it is passed on to the next worker. After all wires are soldered into a plug and inspected, a flexible casing is slipped over the wires and fastened in place, ready for installation into the junction box, bomber's panel, instrument panel or whatever unit of which it is a part.

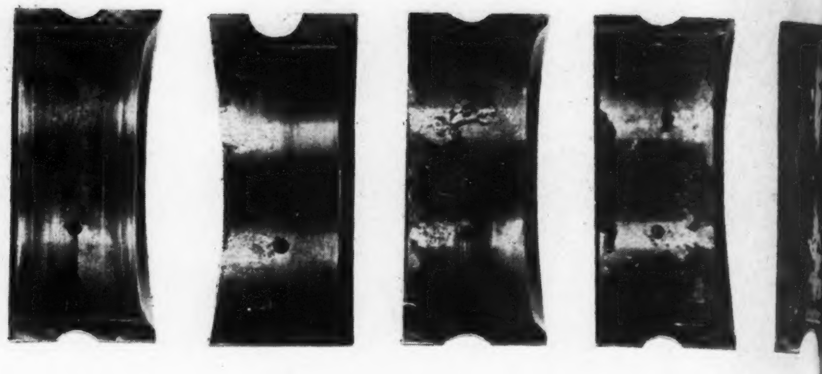


Fig. 1 — Progressive fatigue of babbitt shows minor cracks developing until pieces of babbitt fall out

Practical Aspects of Bearing Design

Part II—Basic Materials

By E. B. Etchells and A. F. Underwood

Research Laboratories Division
General Motors Corporation

IN THE entire subject of bearings no section is as dependent on experience and experimental data as that dealing with selection of the metal for plain bearings. Engineering handbooks and bearing manufacturers list allowable bearing factors for the various alloys. These are reliable guides when the exact design conditions are known and accounted for, but a more fundamental knowledge has much greater value for the machine designer.

In the previous article it was shown that certain requirements are necessary to maintain an oil film, in order to design within the capacity of the bearing. If it were possible always to maintain an oil film between the rubbing surfaces there would be no need for a particular bearing alloy. Journal and bearing could be made from any combination of steel, cast iron, bronze, etc., provided the strength of the material were not exceeded.

In nearly every design the journal is made of an iron alloy dictated by other requirements. Where strength and rigidity are essential steel will, of course, be used. Where ease of casting is desirable, cast iron or one of the cast steels can be employed. Hardness to be obtained is determined mainly by strength and resistance to wear. The bearing material, however, is determined by a number of prerequisites depending upon the design requirements. With no order of relative importance they are listed as follows:

1. Fatigue strength
2. Compressive strength
3. Antifriction properties
4. Conformability
5. Embedability
6. Bonding.

Fatigue strength shows up as in steel. Cracks develop if the load and temperature conditions are sufficiently severe, and a decrease in either will prolong the useful life. When a large enough portion of the bearing surface has fatigued (*Fig.* 1), the oil film conditions deteriorate to the point that failure by overheating quickly follows. A bearing alloy having compressive strength to prevent extrusion of the metal is a correlated consideration. A material having the highest fatigue and compressive strength should be selected, consistent with cost and other listed items.

As a general rule babbitt should be given first consideration. Babbits of lead and tin base are easily handled and have the lowest strengths and cost, lead alloys being

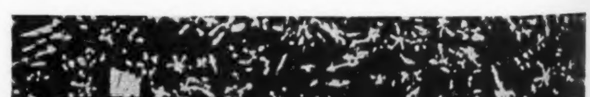


Fig. 2—Tin base babbitt. Dark areas are high in tin, white crystals are hard components of tin, copper and antimony. Magnification 100 diameters

the cheaper. In either case the lining thickness should be a minimum to secure maximum load-carrying ability. Alloys specified as SAE 110 (tin base, *Fig.* 2) and SAE 14 (lead base, *Fig.* 3) are characteristic of the two types. Although there are innumerable variations, it is difficult to obtain greatly improved performance over these two basic alloys, with most of them.

The next class of material is copper-lead which consists of 25 to 45 per cent lead with the remainder copper, *Fig.* 4. Greatly improved fatigue life and compressive strength are found so that bearings lined with it stand up where white metals do not. According to metallurgists these elements do not alloy, but by adding tin an alloy of bronze is formed. Such lead-bronze bearings provide even greater fatigue strength so that loads of 4000 pounds per square inch can be carried in aircraft engine bearings. A steel back is necessary for bonding these materials as they do not have sufficient inherent strength.

Bronze and brass are widely used where loads are high and it is desirable to have a "solid" bearing without the additional strength of a steel shell. Cast iron is similar in strength but is usable only under certain conditions, as explained later. It should be remembered that in every application the appropriate selection is an engineering compromise.

While nearly every designer bases his selection on load-carrying ability as usually measured by pounds per square inch of projected area, it has recently been realized that

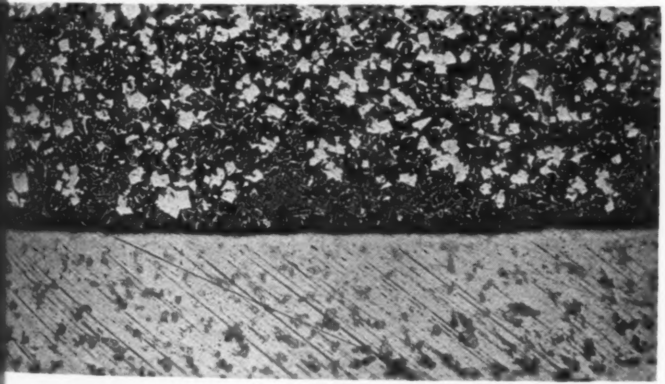


Fig. 3—Lead base bearing material, upper portion, steel backing below. Magnification 100 diameters

the antifriction properties are just as important. If this were not true all bearings would be of cast iron or brass. No longer is it believed that bearings need "hard particles in a soft matrix". This has been repeatedly disproved. Certain metals—elements and alloys—resist scoring when metal-to-metal contact is made with the journal. Other metals—elements and alloys—will readily score and produce tremendous amounts of heat.

It happens that the order of lessening resistance to score is the same as the order for increasing fatigue and compressive strength. Thus the white metals have the least tendency to score and have the lowest fatigue life. There is no material difference between the various babbitt compositions. Some extremely heavily loaded bearings use babbitt because of the need for the highest order of antifriction properties. Automotive bearings carry loads up to 2000 pounds per square inch at a surface speed of 2500 feet per minute.

Mention should be made of single element surfaces which are used only for their excellent antifriction properties. Tin, lead, cadmium, and copper (usually all by electrodeposition) are frequently employed as thin films to resist scoring to steel and cast iron, particularly as a "run-in" surface. Because of their thinness, the load-carrying ability is high. When it is desirable to utilize them as thicker layers it is necessary to add a hardening alloy which gets back to babbitt.

Copper-lead bearings can be used where the highest antifriction requirements are not demanded. If the structure is reasonably rigid for the imposed loads and the oiling is well maintained it will not score. The antifriction qualities are obtained from the lead which is held within the copper sponge. When tin is added to provide a stronger metal the antifriction qualities are decreased even below straight copper-lead.

Use Bronze at Low Speeds

Bronzes should be used only under conditions of high load with slow speed or low load with moderate speed. High surface speeds are liable to produce scoring. Brass and cast iron are so low in antifriction properties that their use is restricted to low load-speed combinations; for example, in certain lathe installations.

There is no specific formula for determining which material is suitable for preventing seizure, so experience is valuable. In a new design a reasonable estimate must be made of the operating conditions and then a selection of material made. It is our practice then to set up a test which reproduces the bearing conditions. A test machine for such a purpose is illustrated diagrammatically in *Fig.* 5. Consider that a 90 per cent copper-10 per cent tin bronze was first selected but the test showed scoring to occur. Copper-lead-tin (say 80-10-10 per cent) would be tried; the addition of the lead would add to the antifriction qualities at the expense of strength. An ultimate use of babbitt might even be indicated by successive tests.

Deflections Affect Performance

Until recently it was often thought that our machines stayed as designed on the board—parallel lines on the board remaining parallel when the load was imposed. Since there is always the modulus of elasticity, deflections develop. The correctly designed machine is one which accounts for deflections. A journal may have several degrees of bellmouthing action within its bearing support. If these supports are rigid, the bearing material will have high end-loading which invites overheating unless the proper conformability is quickly attained. The running-in of a bearing is for this purpose as well as to wear off scratchy surfaces. Increasing the thickness of the lining allows easier adaptability and is one of the reasons why thick babbitt is found in heavy machinery.

Bearing metals conform by wearing away, by plastic flow or by local melting. It is obvious that this property is closely associated with antifriction properties. The relative listing of excellence of conformability is the same as the listing for antifriction. Thus babbitt may conform easily by local melting or flow, copper-lead by flow or wear and bronze or cast iron by wear. It is necessary for this action to take place without excessive heat being

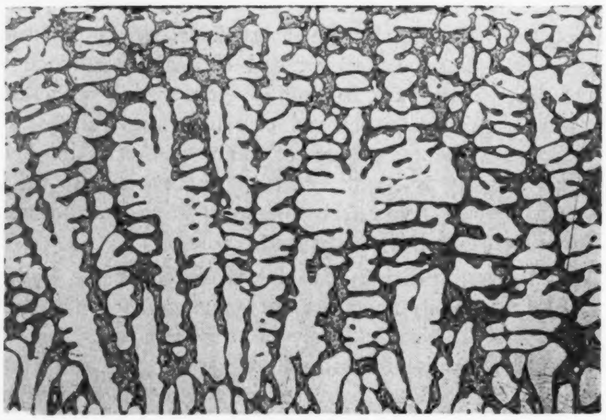


Fig. 4—Copper-lead bearing. White dendrites are copper, gray material is lead, the two materials being insoluble. Magnification 100 diameters

generated to burn out the lining material.

When setting up a test to investigate a bearing element, it is essential that the relative rigidities of the projected machine be maintained. Often the designer must wait for the results of the preliminary investigation to indicate how he can design the bearings to accommodate distortions caused by imposed loads.

The design of a machine should be made with care to exclude dirt and foreign matter as much as possible. With plain bearings it is difficult to accomplish this since such extraneous material is introduced with the lubricant or by ventilation. When hard pieces are thus fed between the journal and bearing, and the lining is too hard for the particles to embed, they must either be ground down in size or produce deep grooves. In either case wear, out-of-roundness and interference with the oil film result. On the other hand, if the bearing lining is soft so that the dirt is easily embedded less trouble can frequently be expected. Babbitt, especially the softer lead base alloys, can absorb dirt to a remarkable extent, thereby reducing wear. It should be realized that if the babbitt becomes charged with an abrasive, the rubbing action will reproduce a lap unless the oil film keeps the metal surfaces apart. A special case of embedability is the rubber bearing for application under water. These bearings have found their widest use in outboard propeller shaft bearings where water is the lubricant. Dirt is continually being fed through. The rubber deforms, allowing the particles temporarily to embed and to pass between the rubbing surfaces with a minimum of damage.

For years it was the correct excuse to claim that the failure of any bearing lining supported on a steel or bronze back was caused by bad bond. The engineer has learned to distinguish between true bad bond and fatigue failure. If the designer calls for a bearing which is overloaded so that fatigue occurs, he no longer can blame the bearing manufacturer. Insufficient bond is likely to show up in a short time. Proper metallographic examination will indicate the condition and the remedy.

Bearing engineering should include a general consideration of the lubricant, which is as important as the materials between which it flows. There is a tremendous amount of information on this subject, most of which is of minor value to the designer. However, he should be acquainted with the SAE grades of oil as a means of specifying suitable viscosity. Viscosity is an important factor in determining load-carrying ability, power loss, temperature, etc., as shown in the previous article.

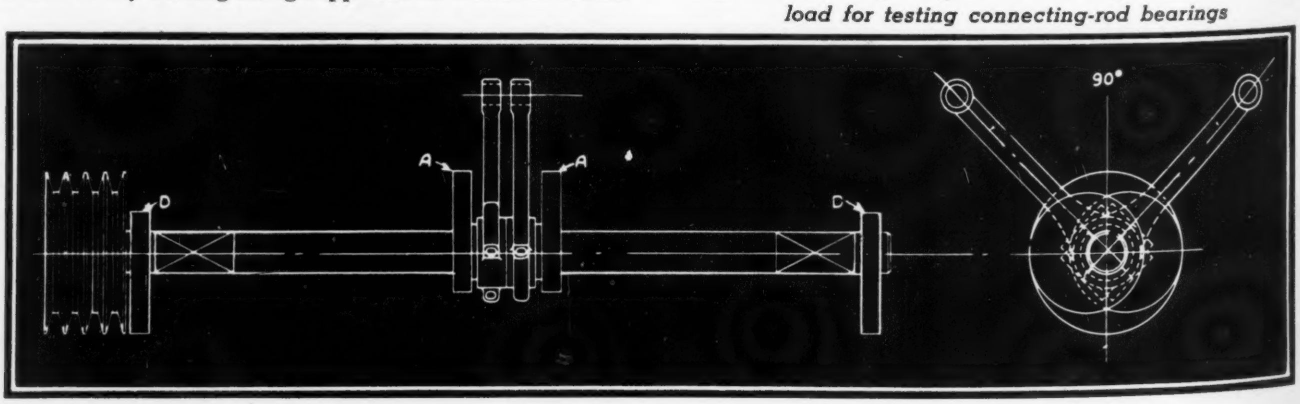
Many machines and engines now being designed subject the oil to greater duty than ever before. An oil which is operated at elevated temperatures will oxidize to form acid, sludge, gum, etc. The effect of acid on a bearing surface is shown in *Fig.* 6. Coolers should be installed if justified by the operating conditions. Research work by the oil industry has developed oils which will resist oxidation through the addition of chemical inhibitors. No standard has been formulated for these products and it is necessary for the engineer to make the supplier responsible. As a general policy it is far better for the designer to produce a mechanism which will operate with a standard quality.

Powdermetal Bearing Properties

In the manufacturing procedure for oilless bearings, copper-tin powder is pressed to shape and sintered to produce a porous bronze sponge. The pores (microstructure is shown in *Fig.* 7) are then filled with lubricant and the bearing is ready for installations in locations where oiling is done at infrequent intervals. When the bearing is heated by rubbing friction during operation the oil is exuded, reducing the friction. High loads cannot be supported due to the porous nature of the matrix.

Commercially pure copper can be obtained by electrodeposition and treating to remove all oxygen but its softness and lack of strength give it little value as a bearing material. The antiscore characteristic is fair. Phosphorus, in small amounts, is often added, especially in making "phosphor bronze". This is not for alloying but to produce a cleaner material by deoxidation, and to improve casting

Fig. 5—Revolving weights A and D produce a rotating load for testing connecting-rod bearings



properties. A residual content of .05 to .1 per cent phosphorus generally indicates effective removal of the oxygen. To this basic metal, copper, numerous elements are added to effect changes in properties, both chemical and physical.

From a bearing standpoint, true brasses are not desirable as they are extremely liable to scoring and to a high rate of wear. However, they are cheaper than copper-tin alloys and are more easily cast. Therefore, in certain relatively unstressed locations, these alloys can be properly used. Copper-zinc alloys are subject to attack by corrosive acids which are developed by oxidation of lubricating oils. Tin is needed to control this action, but zinc is required in the alloy when the oil contains sulphur as in hypoid lubricants.

The technique of casting copper-lead is to get the lead so finely divided and evenly dispersed, that the inevitable segregation cannot be seen with the naked eye. The addition of a few per cent of lead reduces the strength of the alloy so much that alloys containing over 5 per cent of lead have to be cast to shape rather than rolled.

In straight copper-lead bearings, the lead content is usually between 25 and 45 per cent and is the portion that gives the mixture its antiscore quality and plasticity.

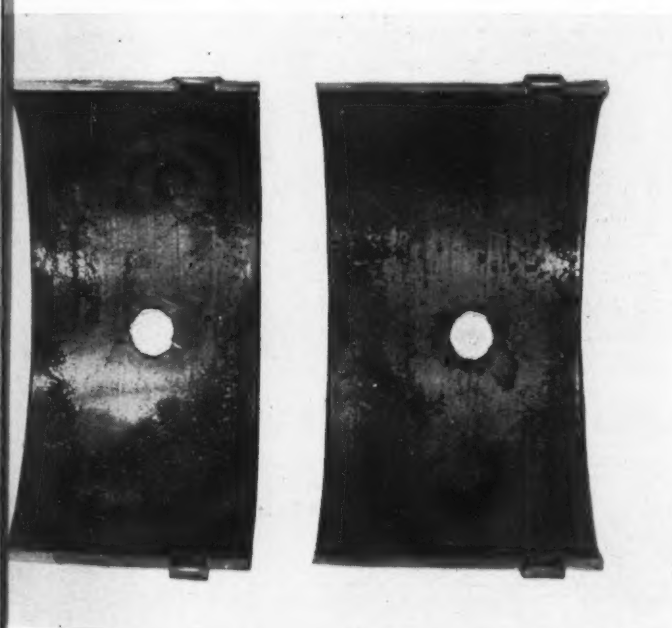


Fig. 6—Acidic lubricating oil caused the corrosion of this copper-lead bearing

The higher percentages of lead give the best antiscore and greater plasticity but are more difficult to cast. This class of bearing material has extremely low tensile strength and it is therefore cast on a steel back. Usually it is found in locations where babbitt would have been used except for the low fatigue strength of babbitt.

Using the four elements copper, tin, zinc, and lead, the possible bushing alloys become practically limitless. With the small variations between many of the compositions it is difficult to justify the variety available. With these facts in mind, TABLE II has been compiled. It will be noticed that those at the top are strong, hard, low non-score quality alloys suitable for high loads and low speed or an oscillating movement. On down the table the tin and zinc are gradually decreased and small amounts of

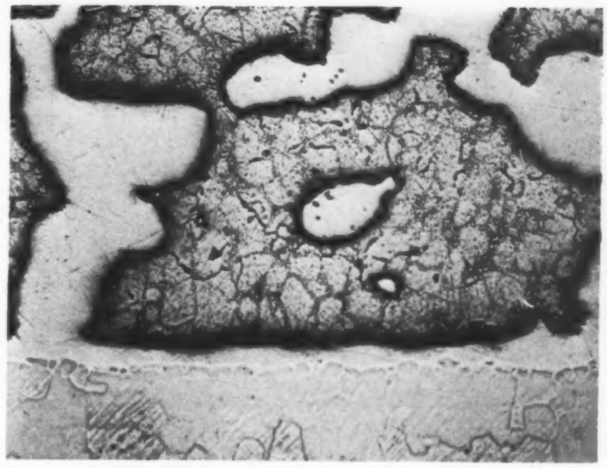


Fig. 7—Oilless bearing is sintered copper-nickel matrix (white) and babbitt (gray). Magnification 100 diameters

lead are shown. This results in alloys which are not as strong or hard but which will withstand metal-to-metal contact without scoring. Next, the copper has a large amount of lead with less and less tin, giving in reality a hardened copper-lead bearing. These bearings are excellent for high speed bushings except where corrosive oil is to be encountered. The final step is the straight copper-lead which is so weak that it requires a steel back

TABLE II

Copper-Rich Bearing Alloys

—Nominal Composition %— Cu	Sn	Zn	Pb	Approx. Hardness and Strength†	Approx. Non-Score Quality†	Possible Application
88	Fe-2	...	Al-10	1	19	Very poor antiscore quality. Used in minor locations and with hypoid oil.
86	Fe-2	8	Al-4	2	18	
90	..	9½	½	3	17	
59	..	39¾	2¼	4	16	
*88	10	2	..	5	15	For heavily loaded wrist pins and similar oscillating motions where lubrication is well maintained.
86	10	2½	1½	6	14	
88	7	3	2	7	13	
83½	10	1½	5	8	12	
88	4½	3¾	4	9	11	Average materials for wrist pins and moderate speed shafts about 1-inch diameter.
82¾	7	3¼	7	10	10	
85	5	5	5	11	9	
*80	10	...	10	12	8	
85	5	1	9	13	7	
70	9	...	21	14	6	For high speed bushings about 1-inch diameter and where lubrication is not well maintained.
*72	8	...	20	15	5	
70	3	...	25	16	4	
71½	3½	...	25	17	3	For heavily loaded connecting rod and main bearings of diesel, truck and aircraft engines.
72	..	...	28	18	2	
60	..	...	40	19	1	

*Typical selection from group. †In order of superiority.

for support. It has the best non-score quality of all, but is the most susceptible to corrosion.

It will be seen that the tolerance of one composition overlaps another composition. Therefore a typical selection has been starred in each group. This is not to be taken as the superior alloy, however, because other specific considerations such as availability, current price, special corrosion resistance may justify another choice.

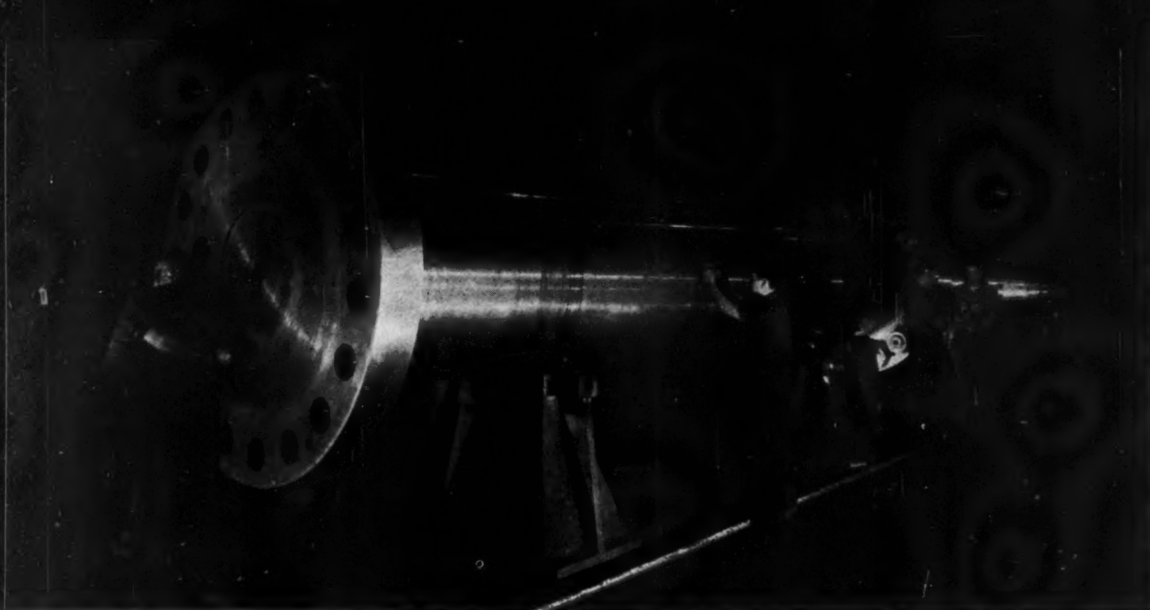


Fig. 12—Shaft of Grand Coulee generator is subject to combined stresses some of which are fluctuating—Photo courtesy Westinghouse

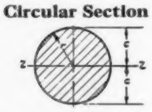
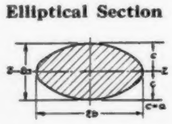
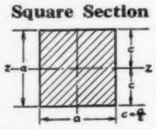
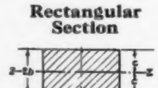
Designing for Bending, Twisting and Axial Loads

Part II—Fatigue Stresses

By Joseph Marin
Pennsylvania State College

IN THE previous article, members of circular and noncircular cross section were considered for static combined loadings consisting of torsion, bending and axial forces. In members such as crankshafts, helical springs and airplane parts, these loads may be fluctuating and the resistance of the material under a fatigue condition must

Values of Stress Ratios and Required Section Modulus

Section	Stress Ratio $R_3 = \frac{S_s'}{S_b'}$	Section Modulus $\frac{I}{c} = \frac{M'}{S_w F}\sqrt{1+3R_3^2}$
Circular Section 	$R_3 = \frac{T'}{2M'}$	$\frac{I}{c} = \frac{M'}{S_w F}\sqrt{1+.75\left(\frac{T'}{M'}\right)^2}$
Elliptical Section 	$R_3 = \frac{T'}{2M'}$	$\frac{I}{c} = \frac{M'}{S_w F}\sqrt{1+.75\left(\frac{T'}{M'}\right)^2}$
Square Section 	$R_3 = \frac{T'}{1.25M'}$	$\frac{I}{c} = \frac{M'}{S_w F}\sqrt{1+1.92\left(\frac{T'}{M'}\right)^2}$
Rectangular Section 	$R_3 = \frac{T'}{6M'}\left(3\frac{a}{b}+1.8\right)$	$\frac{I}{c} = \frac{M'}{S_w F}\sqrt{1+3\left[\frac{T'}{6M'}\left(3\frac{a}{b}+1.8\right)\right]^2}$

then be considered. Only the combined stress effect under these variable loads or stresses will be discussed in the following. It should be noted that for fatigue loading conditions, however, a stress concentration factor sometimes must be incorporatd in the analysis.[1]

To determine the cross-sectional dimensions of members subject to fluctuating combined torsion, bending and axial loads it will be necessary first to determine a general relation to provide for the influence of combined fatigue stresses on the behavior of the material.

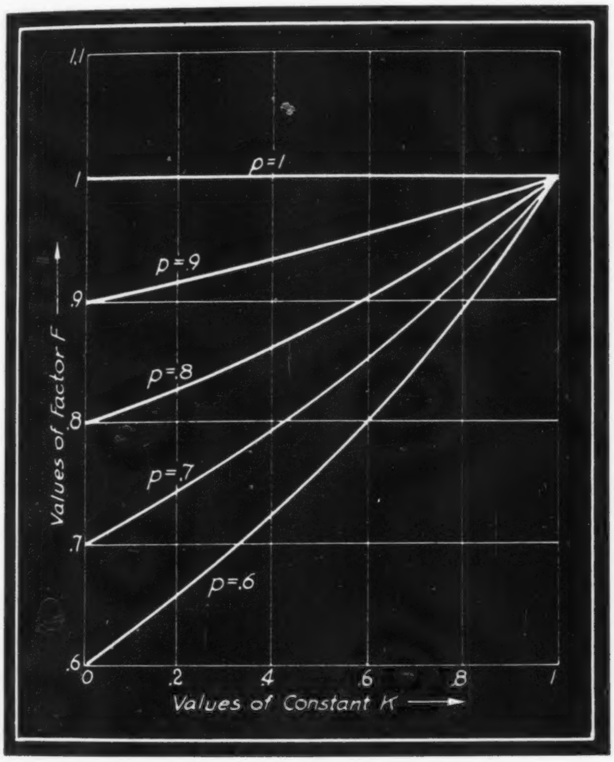


Fig. 13—Values of fatigue factor F

For straight members of various cross sections subject to fluctuating combined stresses, such as typified by *Fig.* 12, there will be a normal stress S_x due to the bending moment and axial loads, and a shear stress S_s due to the torsional moment. These stresses under fluctuating loads will vary, so for a particular element in the member the maximum values of these stress components are S_x' and S_s' while the mean stress values are S_x'' and S_s''. Using the distortion energy theory for fluctuating stresses as described in the previous articles of this series, the equivalent simple static working stress S_w for these stresses is

$$S_w=\frac{1}{p}\left[\sqrt{(S_x')^2+3(S_s')^2}-(1-p)\sqrt{(S_x'')^2+3(S_s'')^2}\right] \quad ..(a)$$

where $p=S_e/S_{yp}$, S_e=the endurance limit for complete reversal and S_{yp}=the yield point strength of the material. Letting S_a and S_b be the axial and bending stresses respectively,

$$S_x=S_a+S_b, \quad S_x'=S_a'+S_b', \quad S_x''=S_a''+S_b'' \quad ....(b)$$

[1]For a treatment of this problem see, for example, the discussion by A. M. Wahl of F. P. Zimmerli's paper, "Relation of Wahl Correction Factor to Fatigue Tests on Helical Compression Springs", *Transactions*, A.S.M.E., Vol. 59, 1937, Page RP-60-2.

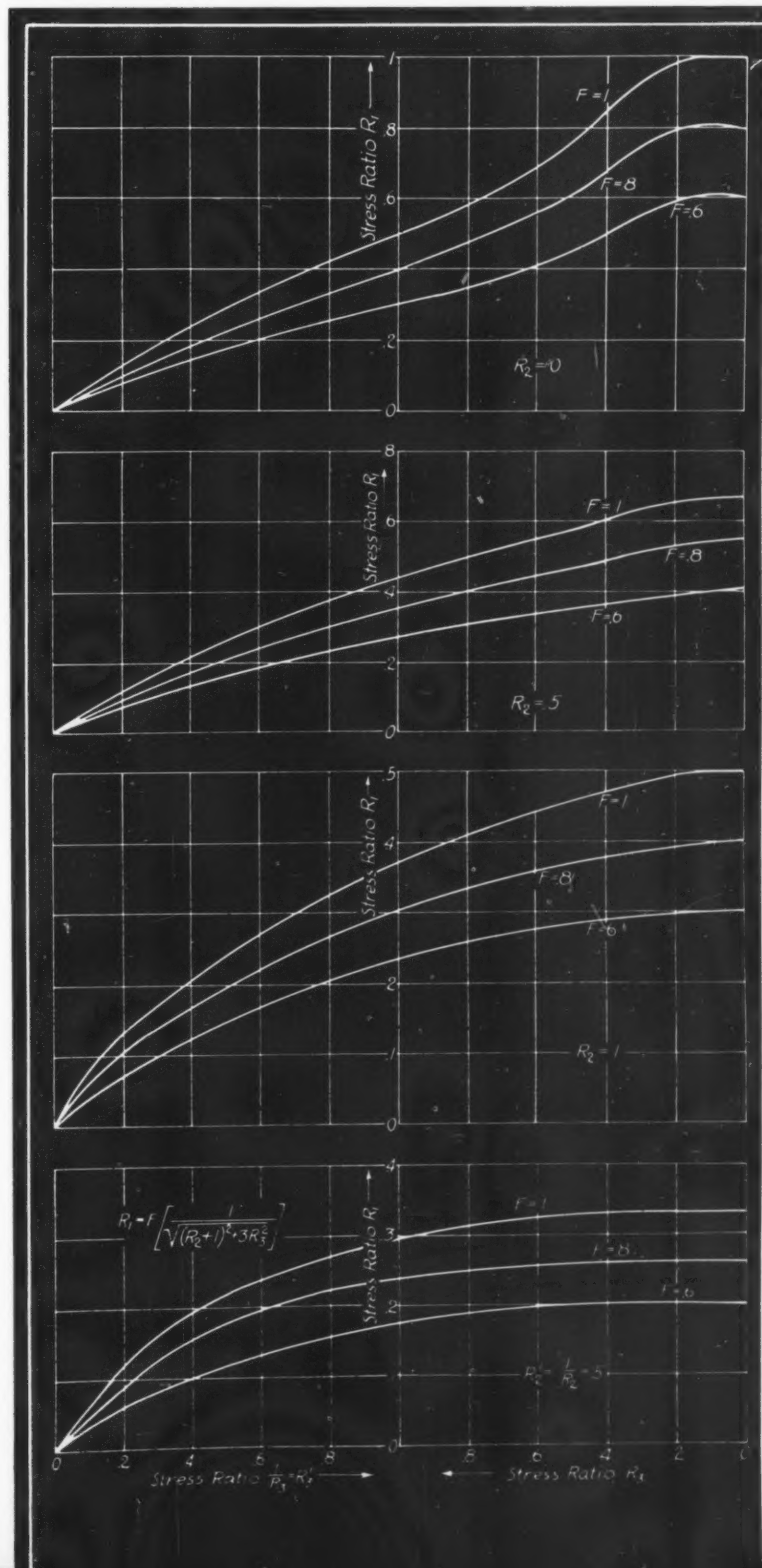
where the prime values are the maximum values of the stress components and the double primes are the mean stress values. As previously stated the theory assumes that the maximum and mean stress components occur at the same instant of time. Placing values of stresses from Equations b in Equation a,

$$S_w=\frac{1}{p}\left[\sqrt{(S_a'+S_b')^2+3(S_s')^2}-\right.$$

$$\left.(1-p)\sqrt{(S_a''+S_b'')^2+3(S_s'')^2}\right] \quad ....(c)$$

If the ratios of the maximum to the mean stress values

Fig. 14—Stress ratios for representative fatigue factors



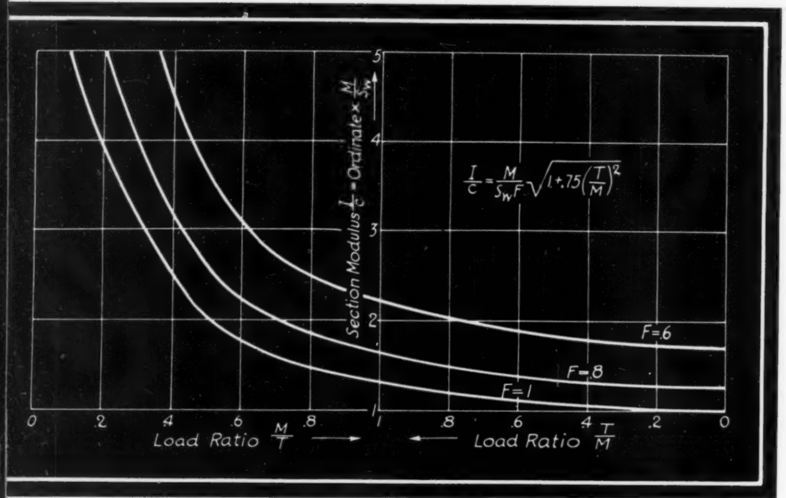
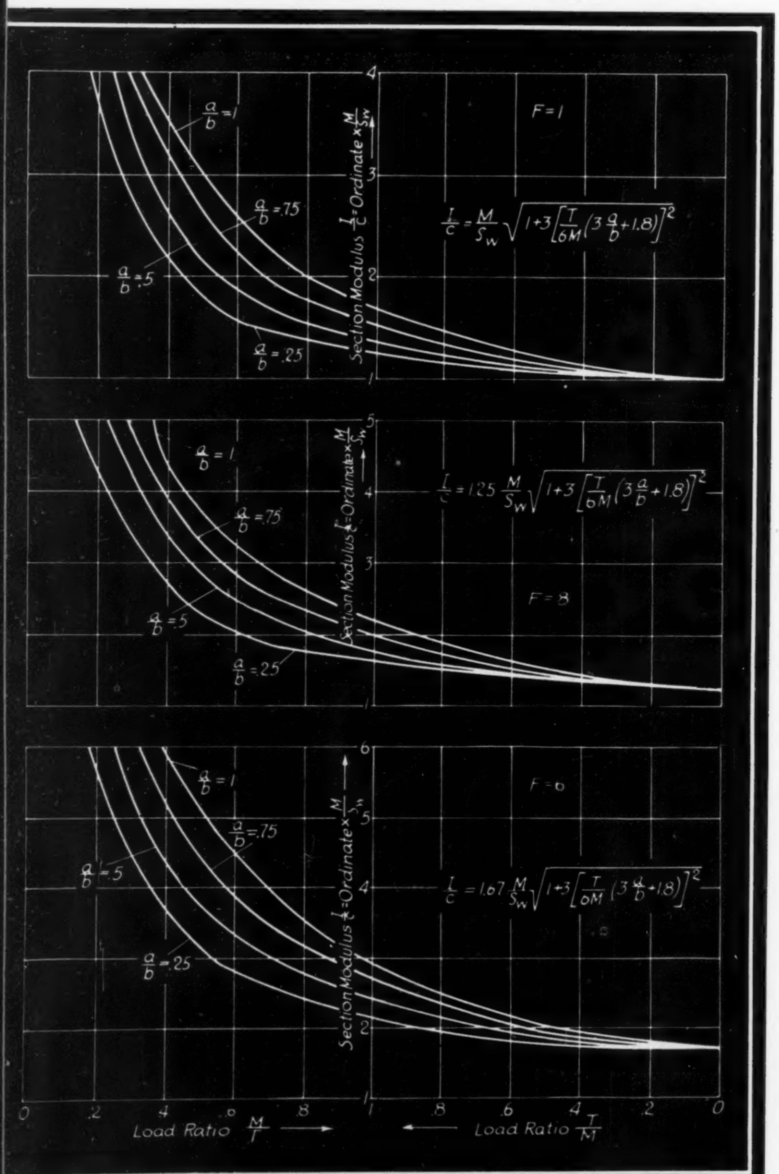


Fig. 15—Required section modulus for circular and elliptical cross sections for various values of fatigue factor

Fig. [16—Below—Section moduli of rectangular cross sections for various values of fatigue factor F



be related as given in the following equations:

$$S_a''=k_1S_a', \quad S_b''=k_2S_b', \quad S_s''=k_3S_s' \qquad (d)$$

where k_1, k_2 and k_3 are stress ratios, Equation c gives the equivalent working stress value equal to

$$S_w=\frac{1}{p}\left[\sqrt{(S_a'+S_b')^2+3(S_s')^2} - (1-p)\sqrt{(k_1S_a'+k_2S_b')^2+3(k_3S_s')^2}\right] \qquad (1)$$

If the values of the stresses in Equation 1 are known for the critical element in the member, Equation 1 can be used directly for determining the equivalent simple static working stress. This equation can also be used, as shown in the following, for finding the required dimensions of members with known loading conditions.

The variation in the working stress value for various possible combinations of the axial, bending and torsional stresses can be determined conveniently for the case where $k_1=k_2=k_3=k$. This corresponds to a common situation in which the stresses are produced by one fluctuating load. Substituting for this condition in Equation 1, the working stress reduces to

$$S_w=\frac{1}{p}(1-k+kp)\sqrt{(S_a'+S_b')^2+3(S_s')^2} \qquad (2)$$

Placing

$$R_1=\frac{S_b'}{S_w}, \quad R_2=\frac{S_a'}{S_b'}, \quad R_3=\frac{S_s'}{S_b'}, \quad \text{and}$$

$$F=\frac{1}{\frac{1}{p}(1-k+kp)} \qquad (3)$$

in Equation 2, the working stress ratio R_1 becomes

$$R_1=\frac{F}{\sqrt{(R_2+1)^2+3R_3^2}} \qquad (4)$$

The magnitude of the working stress ratio R_1 depends upon the values of the stress ratios R_2 and R_3 and the fatigue factor F. The possible variation in the fatigue factor as given by Equation 3 is represented in *Fig.* 13. In plotting these curves the representative values of k and p were selected as shown. An examination of the possible variations in the fatigue factor indicates that the values may vary from about .6 to 1. Variations in the working stress ratios R_1 can be determined for this range of values. This is done by considering Equation 4 and all possible values of the stress ratios R_2 and R_3.

A graphical representation of the variation between the stress ratios R_1, R_2 and R_3 is given in *Fig.* 14 for representative values of the fatigue factor. These charts can be used to determine the allowable value of one of the stresses S_a', S_b' or S_s' for given values of two of these stresses. For example, knowing the value of S_a' and S_b' for the critical element, the values of R_2 and R_1 can be determined. Then by selecting the appropriate diagram and curve, the value of R_3 can be found and hence the allowable value of S_s' calculated.

In many engineering calculations the dimensions of the

(*Continued on Page* 260)

Directory of Materials

SUPPLEMENT TO MACHINE DESIGN, OCTOBER, 1942

Contents

BECAUSE of shortages created by the war, many of the materials listed in this new edition of MACHINE DESIGN'S directory are subject to Government allocation. Since priority regulations are constantly changing, latest information on the availability of a given material can be obtained only through direct contact with the suppliers.

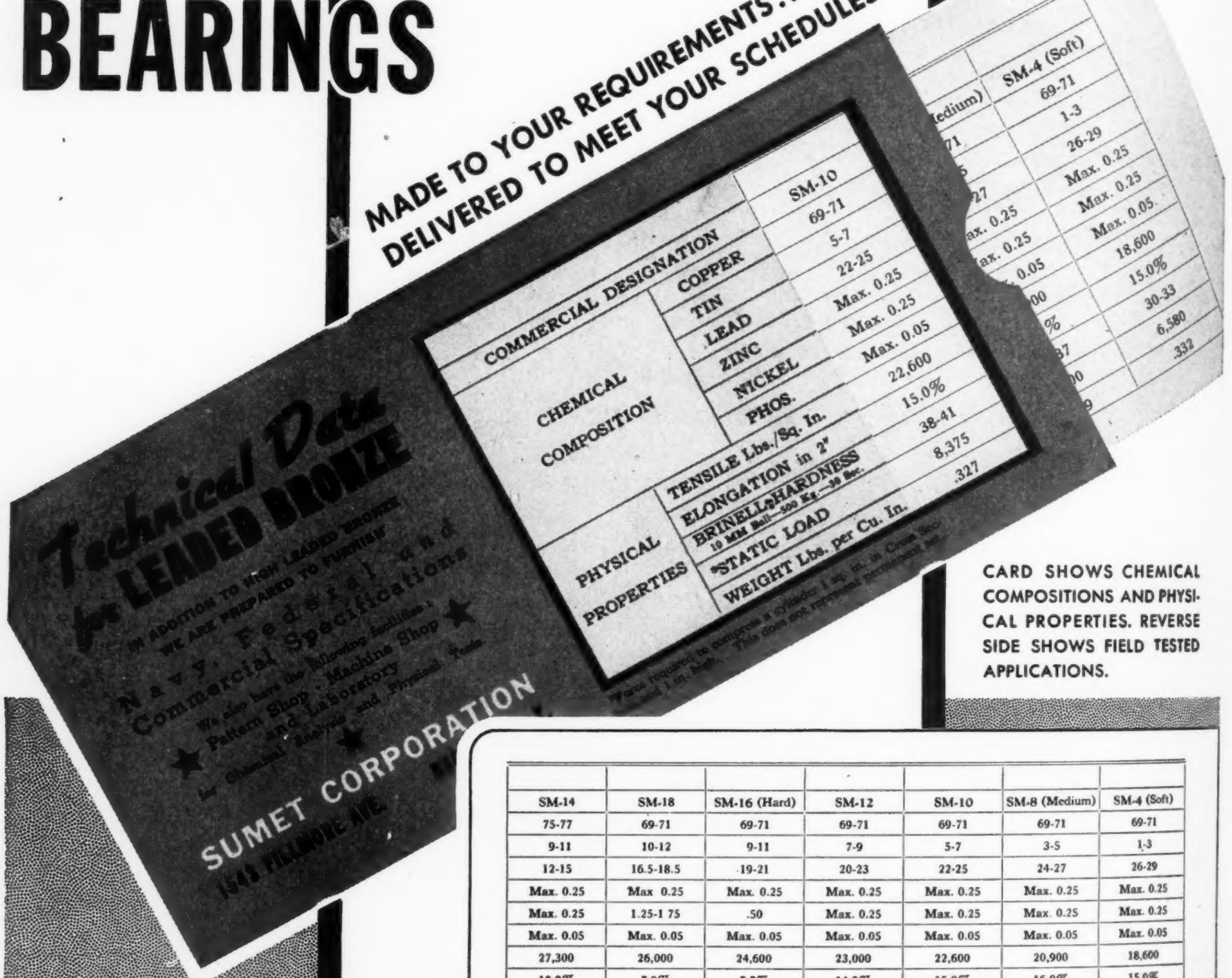
By means of the listing of tradenames of materials, designers may find similar materials produced by several suppliers or may discover satisfactory alternative materials. To facilitate finding different sources of a required material, a cross-index is included in the "Metals" section which lists metal tradenames according to the alloying constituents of the material. A table of the revised SAE steels, to which have been added the new NE steels, also appears in the "Metals" section.

Both the metallic and nonmetallic sections are cross referenced with separate listings of producers' names. Also, a convenient key of numerals is used above each listing to classify the properties of the materials and to aid in their selection.

As with previous issues, reprints of the directory will be available at a nominal charge.

BRONZE CASTINGS... BEARINGS

MADE TO YOUR REQUIREMENTS..AND DELIVERED TO MEET YOUR SCHEDULES



CARD SHOWS CHEMICAL COMPOSITIONS AND PHYSICAL PROPERTIES. REVERSE SIDE SHOWS FIELD TESTED APPLICATIONS.

SM-14	SM-18	SM-16 (Hard)	SM-12	SM-10	SM-8 (Medium)	SM-4 (Soft)
75-77	69-71	69-71	69-71	69-71	69-71	69-71
9-11	10-12	9-11	7-9	5-7	3-5	1-3
12-15	16.5-18.5	19-21	20-23	22-25	24-27	26-29
Max. 0.25	Max 0.25	Max. 0.25	Max. 0.25	Max. 0.25	Max. 0.25	Max. 0.25
Max. 0.25	1.25-1 75	.50	Max. 0.25	Max. 0.25	Max. 0.25	Max. 0.25
Max. 0.05	Max. 0.05	Max. 0.05	Max. 0.05	Max. 0.05	Max. 0.05	Max. 0.05
27,300	26,000	24,600	23,000	22,600	20,900	18,600
12.0%	7.0%	7.7%	14.0%	15.0%	16.0%	15.0%
56-60	58-62	47-52	41-45	38-41	33-37	30-33
12,488	15,450	12,300	9,000	8,375	8,300	6,580
.317	.323	.325	.326	.327	.329	.332

This handy brochure reveals all the pertinent characteristics of our bronze alloys at a glance. It saves figuring and checking. Included in the envelope, but not shown, are graphs indicating safe loads and speeds under good lubricating.

Brochure will be sent on request.

sumet corporation

1543 FILLMORE AVENUE

BUFFALO, N. Y.

Iron, Steel and Nonferrous Metals

Listed by Tradenames

(For listing by producing companies, and complete street addresses, see Page 145.
For index of alloys by principal constituents, see Page 148)

(For listing by producing companies, and complete street addresses, see Page 145. For index of alloys by principal constituents, see Page 148)

1-Corrosion resistant / 2-Heat resistant / 3-Abrasion resistant / 4-High tensile strength / 5-High ductility / 6-Bearing application / 7-Electrical uses / 8-Heat treating / 9-Low specific gravity / 10-Machinability

A

1 - 3 4 - - - - - - -
ABRASOWELD—Lincoln Electric Co., Cleveland. Arc-welding electrode for providing abrasion-resisting, self-hardening deposit which hardens rapidly under impact and abrasion; maximum hardness develops at surface, leaving cushion of softer metal beneath; provides resistance to abrasion in straight carbon, low alloy or high manganese steel surfaces; effective on gear and pinion teeth.

- - - 4 5 6 - - - -
ACORN—A. W. Cadman Mfg. Co., Pittsburgh. Babbitt metal furnished in ingots; brinell hardness 70 degrees Fahr. 23.8, 212 degrees Fahr. 21.8; compressive strength 12,500 lb. per sq. in.· for bearings having reciprocating motion, subject to excessive pound or vibration.

- - - - - 6 - - - -
ADAMANT SUPER-GENUINE BABBITT—Magnolia Metal Co., Elizabeth, N. J. Over 90 per cent tin, free of lead, containing special fluxes; furnished as ingots; specific gravity 7.34; bearing properties good; brinell hardness, untreated 23; used for bearings, diesel engines, connecting rods, etc., subject to shock or strain.

- - 3 - - - - - - -
ADAMANTINE—Babcock & Wilcox Co., New York. Special steel castings with wear-resisting qualities and machinable surfaces; for grinding mills, mixers, conveyors, power shovels.
See advertisement, Page 118

1 2 - - 5 - - - - -
ADNIC—Scovill Mfg. Co., Waterbury, Conn. Copper 70, nickel 29, and tin 1; furnished in rods, bars, tubes, wire, sheets, strips and plates for stamping, turning, boring, welding, deep drawing, cold heading, and brazing; resists corrosion due to organic acids, alkalies, sulphur compounds; resists heat up to 600 deg. Fahr.; tensile strength 55-130,000 lb. per sq. in.; recommended heat treatment, annealing, 1100-1300 deg. Fahr.; brinell hardness, untreated, 70-200; used for condenser tubes and heat exchanger tubes.

- - - 4 - 6 - - - -
AERISWELD—Lincoln Electric Co., Cleveland: arc-welding electrode; for welding of bronze, brass and copper either in manufacturing or maintenance work.

1 - 3 - - 6 - - - -
AETERNA 600 METAL—Allied Process Corp., New York, 60: 40 brass base with manganese and silicon; furnished in rough bars or billets, finished rods or bars and tubing; for hot forging and extruding; corrosion and abrasion resistant; tensile strength 85-90,000 lb. per sq. in.; medium ductility; good bearing properties and weldability; used for bearings, gears, levers, cams, cranks, etc.

1 2 3 - - - - - - -
AGILE-ACTARC—American Agile Corp., Cleveland. Light-gage electrodes for sheet metal welding; fillet welding electrodes; for cast-iron welding, hard-surfacing and other purposes.

1 2 - - - 6 - - - -
AGRICOLA—Saginaw Bearing Co., Saginaw, Mich. Bearing bronze of copper 70, lead 30; impurities less than .2 of 1; resists corrosion caused by acids; resists heat to 500 degrees Fahr.; ductility medium; especially adapted to diesel and airplane engine bearings.
See advertisement, Page 82

1 - - - - - - - - -
ALCLAD—Aluminum Co. of America, Pittsburgh. Duplex aluminum and aluminum base alloys. An example is sheet with a high-strength core (ALCOA alloy 17S or 24S) and a coating of relatively high-purity aluminum with high resistance to corrosion.

1 2 3 4 5 - 7 8 - 10
ALCOA—Aluminum Co. of America, Pittsburgh. Aluminum wrought and casting alloys as follows:

1 - - - 5 - 7 - - -
2S; commercially pure aluminum sheet and plate, rod and bar, wire, tubing, extruded shapes and rivets; ult. tensile strength, 13-24,000 lb. per sq. in.; for sheet metal work, chemical equipment and electrical conductors.

3S; manganese 1.2; in sheet and plate, rod and bar, wire, tubing, extruded shapes, rivets; ult. tensile strength, 16-29,000 lb. per sq. in.; for sheet metal work, gasoline tanks for aircraft, rivets and tubing.

- - - 4 - - - 8 - 10
11S-T3; copper 5.5, lead .5; heat-treatable wire, rod and bar, forgings, screw machine products; ult. tensile strength, 49,000 lb. per sq. in.

- - 3 4 - - - 8 - -
14S-T; copper 4.4, silicon .8, manganese .8, magnesium .4; heat-treatable forgings; ult. tensile strength, 70,000 lb. per sq. in.; for heavy duty forgings, power shovel bails, airplane fittings.

1 - 3 4 - - - - - -
17S; copper 4, manganese .5, magnesium .5; sheet and plate, rod and bar, wire, tubing, rolled and extruded shapes, rivets, forgings and screw machine products; ult. tensile strength, 26-62,000 lb. per sq. in.; for structural applications in construction and transportation fields.

- 2 - 4 - - - 8 - -
18S-T; copper 4, magnesium .5, nickel 2. heat-treatable forgings; ult. tensile strength, 63,000 lb. per sq. in.; used for forged aircraft engine pistons where good strength at elevated temperatures are required.

1 - - 4 - - - 8 - -
24S; copper 4.6, manganese .6, magnesium 1.5; in sheet and plate, alclad, rod and bar, wire, tubing, extruded shapes, rivets; ult. tensile strength, 26-70.000 lb. per sq. in.; for structural construction in aircraft.

- - - 4 - - - 8 - -
25S-T; copper 4.5, silicon .8, manganese .8; forgings for airplane propellers; ult. tensile strength, 57,000 lb. per sq. in.

- 2 - - - - - - - -
32S-T; copper .9, silicon 12.5, magnesium 1.0, nickel .9; heat-treatable forgings for pistons; ult. tensile strength, 56,000 lb. per sq. in.

1 - - 4 - - - 8 - -
A51S-T; silicon 1, magnesium .6, chromium .25; heat-treatable forgings for machine and automotive parts; ult. tensile strength, 47,000 lb. per sq. in.

1 - - - 5 - - - - -
52S; magnesium 2.5, chromium .25; furnished in sheet and plate, rod, bar, wire and tubing for sheet metal work, marine and transportation applications; ult. tensile strength, 29-41,000 lb. per sq. in.

1 - - 4 5 - - - - -
53S; silicon .7, magnesium 1.3; chromium .25; furnished in sheet and plate, rod and bar, wire, tubing, rolled and extruded shapes, rivets, screw machine parts and forgings; ult. tensile strength, 16-39.000 lb. per sq in.; excellent corrosion resistance, better combination of strength and workability than 52S.

- - - 4 5 - - - - 10
61S; copper .25, silicon .6, magnesium 1, chromium .25; ult. tensile strength, 18-45,000 lb. per sq. in.; in sheet and plate; extruded shapes and tubing: used as substitute for 53S when good machinability is desired and lower corrosion resistance acceptable.

- - - 4 5 - - - - -
13; silicon 12, ult. tensile strength, 33,000 lb. per sq. in.; a general purpose alloy for large, intricate parts.

1 - - - - - - - - -
43; silicon 5, ult. tensile strength, 29,000 lb. per sq. in.; available as sand, permanent mold and die castings; used where castings must be leakproof under pressure.

- - - - - - - - - 10
81; copper 7, silicon 3; ult. tensile strength 32,000 lb. per sq. in.; for general purpose castings.

- - - - 5 - - - - -
83; copper 2, silicon 3; ult. tensile strength, 30,000 lb. per sq. in.; available as die castings for parts requiring moderate ductility.

- - - 4 5 - - - - -
85; copper 4, silicon 5; ultimate tensile strength, 35,000 lb. per sq. in.; for brackets, frames and levers with thick sections.

- - - - - - - - - 10
93; copper 4, silicon 2, nickel 4; ult. tensile strength, 33,000 lb. per sq. in.; furnished as die castings for parts requiring considerable polishing and machining.

1 - - 4 5 - - - - -
218; magnesium 8; ult. tensile strength 38,000 lb. per sq. in.; furnished as die castings for marine fittings, etc.

108; copper 4, silicon 3. zinc 1.7; furnished as sand castings for manifolds, valves and other intricate castings requiring pressure tightness; ult. tensile strength, 21,000 lb. per sq. in.

A108; copper 4.5, silicon 5.5; furnished as permanent-mold castings for general purpose castings of intricate design; ult. tensile strength, 28,000 lb. per sq. in.

- - - - - - - - - 10
112; copper 7, zinc 1.7, iron 1.2; furnished as sand castings for crankcases, oilpans, cylinder heads, and other automotive applications; ult. tensile strength, 23,000 lb. per sq. in.

1—Corrosion resistant
2—Heat resistant
3—Abrasion resistant
4—High tensile strength
5—High ductility
6—Bearing application
7—Electrical uses
8—Heat treating
9—Low specific gravity
10—Machinability

B113; copper 7, silicon 1.7, iron 1.2; available in permanent-mold castings for machinery parts, and general-purpose castings; ult. tensile strength, 28,000 lb. per sq. in.

C113; copper 7, silicon 3.5, zinc 2, iron 1.2; permanent-mold castings for automotive-engine cylinder heads; ult. tensile strength, 30,-000 lb. per sq. in.

- 2 3 4 - - - - - -

122; copper 10, magnesium .2, iron 1.2; heat-treatable sand and permanent-mold castings for automotive pistons, camshaft bearings, valve tappet guides; ult. tensile strength, 31-48,000 lb. per sq. in.

- 2 - 4 - - - - - -

A132; copper .8, silicon 12, magnesium 1, nickel 2.5 and iron .8; heat-treatable permanent mold castings for pistons; ult. tensile strength, 36-38,000 lb. per sq. in.

- 2 - - - - - - - -

138; copper 10, silicon 4, magnesium .2, iron 1; permanent mold castings for brake drums and pistons; ult. tensile strength, 28,000 lb. per sq. in.

- 2 - - - 6 - - - -

142; copper 4, magnesium 1.5, nickel 2; heat-treatable sand and permanent-mold castings; for pistons and aircooled cylinder heads; ult. tensile strength, 40-47,000 lb. per sq. in.

172; copper 8, silicon 2.5; sand castings for match plates and metal patterns; ult. tensile strength 23,000 lb. per sq. in.

- - - 4 - - - - - -

195; copper 4.5; heat-treatable sand castings with good combination of strength and shock resistance; ult. tensile strength, 31-40,000 lb. per sq. in.

B195; copper 4.5, silicon 2.5; heat-treatable permanent-mold castings, ult. tensile strength, 40-45,000 lb. per sq. in.

212; copper 8, silicon 1.2, iron 1; sand castings; ult. tensile strength, 22,000 lb. per sq. in.

1 - - - - - - - - -

214; magnesium 3.8; sand castings for carburetor cases and machine parts; ult. tensile strength, 25,000 lb. per sq. in.

A214; magnesium 3.8, zinc 1.8; permanent mold castings for marine fittings, ult. tensile strength, 27,000 lb. per sq. in.

1 - - 4 - - - - - -

220; magnesium 10; heat-treatable sand castings for aircraft fittings, railroad car parts, heavy-duty castings and marine applications; ult. tensile strength, 45,000 lb. per sq. in.

1 - - - - - - - - -

355; copper 1.3, silicon 5, magnesium .5; heat-treatable sand and permanent-mold castings for cylinder heads and crankcases for diesel and liquid-cooled aircraft engines; ult. tensile strength, 28-35,000 lb. per sq. in.

1 - - 4 - - - - - -

356; silicon 7, magnesium .3; heat-treatable sand and permanent-mold castings; for high-strength, pressure-tight castings of intricate shapes; ult. tensile strength, 28-40,000 lb. per sq. in.

645; copper 2.5, zinc 11, iron 1.2; sand castings for machine parts not subject to high temperatures or corrosive conditions; ult. tensile strength, 29,000 lb. per sq. in.

1 - - - - - 7 - - -

ALCUMITE—Duriron Co. Inc., Dayton, O. Copper 90, aluminum 9, iron 1; for pumps, valves, pipe, fittings, bars and castings for corrosive service where a copper base alloy is preferred.

- - - - - - 7 - - -

ALLEGHENY LUDLUM — Allegheny-Ludlum Steel Corp., Pittsburgh.

"4750"; furnished in rods, sheets, coiled strips and laminations for stamping, forming and drawing. Nickel 47-50, balance iron. Has very high permeability when dry-hydrogen annealed after fabrication; recommended heat treatments, 1800-2000 degrees Fahr. in dry hydrogen; used in audio transformers, sensitive relays and electrical instruments.

"88"; furnished in rods, sheets and plates for stamping, boring and welding. Nickel, 6½-14; manganese, 5-12; balance, iron. Is nonmagnetic whether hard-worked or soft-annealed. Weldability, fair; recommended heat treatment, 1400-1475 degrees Fahr. Used where strength is required combined with nonmagnetic properties.

- - - - - - 7 - - -

Electrical steels furnished in sheets and coiled strips for stamping; ½-4½ per cent silicon according to requirements. Has magnetic and electrical properties, high permeability; high electrical resistance; non-aging; above 1½ per cent silicon content; good surface insulation; fair weldability; recommended heat treatment, 1400-1450 degrees Fahr.; used for motor laminations.

- - - - - - 7 - - -

Relay steels furnished in rods or bars for turning, boring, etc.; 1-2½ per cent silicon. Has magnetic properties, high permeability; nonaging; electrical properties; low retentivity, low coercive force; weldability fair; recommended heat treatment, 1500-1550 degrees Fahr.

See advertisement, Page 99

1 - - 4 - - - - - -

ALLEGHENY METALS—Allegheny-Ludlum Steel Corp., Pittsburgh.

18-8, type 302; carbon over .08-.2, chromium 17.5-20, nickel 8-10; a basic chromium-nickel stainless steel having general corrosion resistance.

18-8-C, type 347; chromium 17-20, nickel 8-12; basic 18-8 analysis modified by addition of columbium for stabilization of alloy within the critical range of 900-1500 degrees Fahr.

18-8-M, type 317; carbon .1 max., chromium 18-20, nickel 10-14; basic 18-8 analysis modified by addition of molybdenum for increased corrosion resistance.

18-8-EZ, type 303; carbon .2 max., chromium 17.5-20, nickel 8-10; basic 18-8 analysis modified to provide free machining properties.

20-10-S, type 308; carbon .08 max., chromium 19-22, nickel 10-12; a chromium-nickel stainless steel designed for certain applications requiring slightly higher general corrosion resistance than that of 18-8 alloy.

25-12, type 309; carbon .2 max., chromium 22-26, nickel 12-14; a chromium-nickel stainless steel for elevated temperature applications requiring ease of fabrication and a high degree of oxidation resistance and high strength and creep values up to 2000 degrees Fahr.

25-20, type 310; carbon .25 max., chromium 24-26, nickel 19-21; a chromium-nickel steel similar to type 25-12 but exhibiting greater stability due to its higher alloy content. Coefficient of expansion is closer to that of plain steel than those of the other chromium-nickel alloys listed.

12, type 410; carbon .15 max., chromium 10-14; a high strength chromium stainless steel possessing excellent resistance to corrosion and oxidation; a type which responds to heat treatment.

12-EZ, type 416; carbon .15 max., chromium 12-14; similar to type 12 but modified to provide free-machining properties.

12-TB, type 403; carbon .15 max., chromium 11.5-13; a high strength chromium steel widely used to meet requirements of turbine construction which calls for high elastic limit and impact values.

12-2, type 414; carbon .15 max., chromium 10-14, nickel 2 max.; a high strength chromium steel with small nickel content possessing properties of basic Allegheny Metal 12 alloy, but with more definite response to heat treatment.

1 - - 4 - - - - - -

17, type 430; carbon .12 max., chromium 14-18; a low-carbon, high-chromium structural steel possessing high degree of resistance to chemical and atmospheric corrosion and oxidation up to 1600 degrees Fahr., together with high strength and ease of fabrication.

17-EZ, type 340F; carbon .12 max., chromium 14-18; similar to Allegheny Metal 17 but modified to provide free-machining properties.

21, type 442; carbon .35 max., chromium 18-23; and 18-23 per cent straight chromium alloy designed primarily for high temperature service in applications not involving difficult fabrication.

28, type 446; carbon .35 max.; chromium 23-30; a straight chromium alloy which offers excellent resistance to chemical corrosion and to oxidation up to 2150 degrees Fahr.

H-17, type 440; carbon over .12, chromium 14-18; a 17 per cent chromium alloy steel with high carbon which through heat treatment develops maximum hardness and wear resistance, together with high strength and corrosion resistance.

M-17, type 440; carbon over .12, chromium 14-18; an alloy similar to H-17 but with lower carbon, possessing increased resistance to corrosion and higher impact values with somewhat lower hardenability.

L-12, type 420; carbon over .15, chromium 12-14; a 12-14 per cent chromium alloy steel which, due to its higher carbon content, can be heat treated to greater hardness than Allegheny Metal 12 and 12-2 with but slight impairment of the corrosion-resistant qualities of either.

46, types 501 and 502; carbon for 501 over .1 and for 502, .1 max.; chromium for both types 4-6; a low chromium alloy structural steel possessing strength and corrosion and oxidation-resistance intermediate to those of plain carbon steel and the regular stainless steels. Available with molybdenum for increasing tensile and creep strengths at high temperatures.

See advertisement, Page 99

- - - - - - 7 - - -

ALNICO—General Electric Co., Schenectady, N. Y. Permanent magnet alloy of high coercive force; nickel 20-30 per cent, aluminum 10-12, cobalt 3-5, balance iron; extremely hard and difficult to machine. Available in both sintered and cast form. Sintered Alnico furnished by General Electric and cast Alnico by the following: Arnold Engineering Co., Chicago; Belden Mfg. Co., Chicago; Cinaudagraph Corp., Stamford, Conn.; Crucible Steel Co. of America, New York; General Magnetic Corp., Chicago; Indiana Steel Products Co., Chicago; Simonds Saw & Steel Co., Lockport, N. Y.; Taylor-Wharton Iron & Steel Co., High Bridge, N. J.: and Thomas and Skinner Steel Products Co., Indianapolis.

- - - 4 - - - - - -

ALUMINWELD—Lincoln Electric Co., Cleveland. A 5 per cent silicon-aluminum-alloy electrode for arc welding aluminum in any form—cast, sheet, shapes, or extruded forms. For either metallic or carbon arc welding. Welds are very dense without porosity and possess high tensile strength.

1 2 - 4 - - - - - -

AMBRAC—American Brass Co., Waterbury, Conn. Alloy 850; copper 75, zinc 5, nickel 20; high ductility; used for condenser tubes, etc.

See advertisements, Pages 92-93

- - - - 5 - - 8 - -

AMERCUT—American Steel & Wire Co., Cleveland. Cold finished carbon and alloy steel bars either cold drawn, annealed, normalized, spheroidized or quenched and tempered to meet various combinations of definite physical, magnetic, corrosion-resistant or machinability property specifications; for screw machine use or shafting.

1 2 - - - - 7 - - -

AMERICAN—American Nickeloid Co., Peru, Ill. Bonded metals; chromium, nickel, brass, copper, gold resemblance and colors bonded to base metals such as steel, tin-plate, zinc, brass, copper, aluminum and nickel silver. Available in brilliant finishes and patterns as sheets, flat strips, coiled strip and round edge flat wire. Can be supplied with gum adhered paper covering protecting prefinish in drawing and forming.

1 2 - - - - 7 - - -

AMERICAN COPPER STEEL—American Nickeloid Co., Peru, Ill. Copper plated to steel, latter serving as rust-resistant, inexpensive metal, conserving quantities of critical solid copper. Available in polished and unpolished finishes in sheets, flat strips and coiled strip for continuous feed automatic presses.

1-Corrosion resistant
2-Heat resistant
3-Abrasion resistant
4-High tensile strength
5-High ductility
6-Bearing application
7-Electrical uses
8-Heat treating
9-Low specific gravity
10-Machinability

\- - - - 5 - - 8 - 10

AMERICAN QUALITY—American Steel & Wire Co., Cleveland. Carbon steels and alloys in the form of cold-rolled strip, manufacturer's wire and springs.

\- - 3 4 - - - 8 - -

AMOLA—Chrysler Corp., Detroit. Also made by various steel companies as licensees under patent controlled by Chrysler Corp. Machinery and constructional steels furnished in 20 grades which vary in analyses only in regard to carbon content. Basically the analysis is manganese .7-.9, phosphorus (max.) .04, sulphur (max.) .04, silicon .2-.3, and molybdenum .15-.25. Used for carburized gears, axle shafts, and springs, with as little thickness as 5/1000 of an inch.

MS 244 electric furnace, carbon .66-.7.

MS 245 open hearth; entire formula same as MS 244.

MS 246 electric furnace; carbon .6-.65.

MS 247 open hearth; carbon same as MS 246.

MS 248 electric furnace; carbon .55-.6.

MS 249 open hearth; carbon same as MS 248.

MS 260 electric furnace; carbon .5-.55.

MS 261 open hearth; carbon same as MS 260.

MS 262 electric furnace; carbon .45-.5.

MS 263 open hearth; carbon same as MS 262.

MS 266 electric furnace; carbon .4-.45.

MS 267 open hearth; carbon same as MS 266.

MS 268 electric furnace; carbon .35-.4.

MS 269 open hearth; carbon same as MS 268.

MS 270 electric furnace; carbon .3-.35.

MS 271 open hearth; carbon same as MS 270.

MS 276 electric furnace; carbon .25-.3.

MS 277 open hearth; carbon same as MS 276.

MS 290 electric furnace; carbon .20-.25.

MS 291 open hearth; carbon same as MS 290.

1 - 3 4 5 6 - - - -

AMPCO METAL—Ampco Metal Inc., Milwaukee. Special copper-base alloys for wear and corrosion-resistant service; produced in seven grades.

1 - - - 5 6 - - - -

Grade 12; copper 88.2, aluminum 8.6, iron 2.9, others .3; furnished in rods, bars, sheets, and plates, for hot forging, turning, boring and welding; also as sand or centrifugal castings; corrosion resistant; resists heat to 1000 degrees Fahr.; low abrasion resistance; tensile strength 65,000 lbs. per sq. in.; compressive strength 120,000 lb. per sq. in.; high ductility; specific gravity 7.735; good bearing properties; nonmagnetic; brinell hardness 115; for use as bushings and bearings.

\- - - 4 5 6 - - - -

Grade 16; copper 86.2, aluminum 10.2, iron 3.3, others .3; furnished in rods, bars, sheets and plates, for hot forging, turning, boring and welding; also as sand or centrifugal castings; corrosion resistant; resists heat to 1000 degrees Fahr.; medium abrasion resistance; tensile strength, 75,000 lb. per sq. in.; compressive strength, 125,000 lb. per sq. in.; high ductility; specific gravity 7.628; good bearing properties; nonmagnetic; fair weldability; brinell hardness, heat treated, 137; used for bearings, gears, wormwheels, liners, lead screw nuts—all for heavy duty where exceptional resistance to wear is required.

1 - - 4 - 6 - - - -

Grade 18; copper 84.6, aluminum 11.3, iron 3.2, others .4; furnished in rods, bars, sheets and plates, for hot forging, turning, boring, and welding; also as sand or centrifugal castings; corrosion resistant; resists heat to 1000 degrees Fahr.; tensile strength 80-85,000 lb. per sq. in.; compressive strength 136,000 lb. per sq. in.; medium ductility; good bearing properties; nonmagnetic; brinell hardness, heat treated, 173; for use as heavy-duty, wear-resistant gears, wormwheels, feed nuts, bearings, welding bases and pickling equipment.

\- - 3 4 - 6 - - - -

Grade 18-23; aluminum 10.6-11.2, iron 3.4-4, others .4 max., copper balance; furnished in rough bars or billets and as sand casting for hot forging; resists heat to 750 degrees Fahr.; high abrasion resistance; tensile strength 95-105,000 lb. per sq. in.; good bearing properties; weldability good; used for parts requiring high strength, good bearing and wearing resistance.

1 - - 4 - 6 - - - -

Grade 20; copper 83.13, aluminum 12.40, iron 4.07, and others .4; available as sand and centrifugal castings; corrosion resistant; resists heat to 1000 degrees Fahr.; high abrasion resistance; tensile strength 85,000 lb. per sq. in.; compressive strength 146,000 lb. per sq. in.; specific gravity 7.437; good bearing properties; nonmagnetic; brinell hardness, untreated, 241; for use as cams and cam rollers, welding jaws, bushings, bearings. and other wear resistant parts.

\- - 3 4 - 6 - - - -

Grade 21; copper 82.34, aluminum 13.02, iron 4.14, others .5; available as sand and centrifugal castings: resists heat to 1000 degrees Fahr.; high abrasion resistance; tensile strength, ult., 90,000 lb. per sq. in.; compressive strength, ult., 160,000 lb. per sq. in.; ductility, low; specific gravity, 7.152; fair bearing properties; nonmagnetic, brinell hardness, untreated, 311; for use as forming and drawing dies, bushings and bearings replacing hardened steel.

\- - 3 4 - 6 - - - -

Grade 22; copper 81.67, aluminum 13.42, iron 4.41, others .5; available as sand and centrifugal castings; resists heat to 1000 degrees Fahr.; high abrasion resistance; tensile strength 90,000 lb. per sq. in.; compressive strength 171,000 lb. per sq. in.; low ductility; specific gravity 7.125; fair bearing properties; nonmagnetic; brinell hardness, untreated, 335; for use as forming and drawing dies.

See advertisement, Page 88

1 - - 4 - 6 - - - -

AMPCO-TRODE—Ampco Metal Inc., Milwaukee. Coated welding rods in the six aluminum bronze alloys listed under Ampco Metal. Used for welded overlays on steel and cast iron for bearing or corrosion resisting purposes for welded fabrication of aluminum bronze or brass sheets and castings.

See advertisement, Page 88

1 - - 4 5 6 - - - -

AMPCOLOY—Ampco Metal Inc., Milwaukee. Various grades of copper-base alloys.

1 - - 4 5 - - - - -

Grade E-1; copper 89, aluminum 10, iron 1; furnished in rough bars or billets, rods or bars, for sand casting, hot forging, extruding, turning, boring, and as centrifugal castings. Resists corrosion caused by acids and other corrosives; resists heat to 1000 degrees Fahr.; medium abrasion resistant; tensile strength, ult., 70-80,000 lb. per sq. in.; compressive strength, ult., 136,000 lb. per sq. in.; ductility, high; specific gravity, 7.48; bearing properties, good; nonmagnetic; used for gears, pickling equipment, bearings, screw down nuts.

\- - - 4 5 6 - - - -

Grade E-123; same analysis as E-1; furnished in rough bars or billets and finished rods and bars, for sand casting, hot forging, turning, boring, and as centrifugal castings. Resists heat to 1000 degrees Fahr.; medium abrasion resistant; tensile strength, ult., 90,000 lb. per sq. in.; compressive strength ult., 145,000 lb. per sq. in.; ductility, medium; specific gravity, 7.48; bearing properties, good; nonmagnetic; weldability, fair; for gears, worm wheels, nuts and bearings.

1 - - 4 5 - - - - -

Grade A-3; same analysis as E-1; furnished in rough bars or billets, finished rods or bars and plates, for sand casting, hot forging, turning, boring, and as centrifugal castings. Resist corrosion caused by acids and other corrosives; resists heat to 1000 degrees Fahr.; medium abrasion resistant; tensile strength, 75,000 lb. per sq. in.; compressive strength, ult., 135,000 lb. per sq. in.; ductility, high: bearing properties, good; nonmagnetic; weldability, good; brinell hardness, untreated, 120; for gears, forgings, bushings, bearings, and pressure parts. Heat treated will meet Fed. Spec. QQ-B-671 Grade B.

\- - - 4 5 6 - - - -

Grade A-323; same analysis as E-1; furnished in rough bars or billets, finished rods or bars and plates, for sand casting, hot forging, turning, boring, and as centrifugal castings. Resists corrosion caused by mild corrosives; resists heat to 1000 degrees Fahr.; medium abrasion resistant; tensile strength, ult., 85,000 lb. per sq. in.; compressive strength ult., 136,000 lb. per sq. in.; ductility, high; specific gravity, 7; bearing properties, good; nonmagnetic; weldability, good; used for gears, bushings, bearings, sleeves and forks.

See advertisement, Page 88

1 2 3 4 5 - - 8 - -

AMSCO—American Manganese Steel Div., The American Brake Shoe & Foundry Co., Chicago Heights, Ill.

\- - 3 4 5 - - - - -

Manganese steel; 10-14 manganese, 1-1.40 carbon, balance iron; suitable for sand casting; for power shovel dippers and teeth, rock crusher parts, dredge pumps, etc.

1 2 - 4 - - - - - -

Alloy F-1; 15-18 chromium, 34-37 nickel; for molten metal and containers, liquid containers, and furnace parts for heat treating, especially under frequent and drastic temperature changes; heat resistant to 2100 degrees Fahr.; creep resistant at high temperatures.

F-3; 26-29 chromium, 3 max. nickel; for rabble arms and blades, sintering bars, etc.; heat resistant to 1800 degrees Fahr. where temperature changes are not wide and where high unit strength is not essential.

F-5; 17-20 chromium, 64-70 nickel; furnace conveyor pans, heat treating boxes, enameling fixtures, etc.; similar properties to F-1 and F-6, except tougher and more resistant to temperature fluctuations.

F-6; 12-15 chromium, 58-64 nickel; for heat treating boxes, retorts, etc.; where temperature changes or uneven heating are severe.

F-8; 19-22 chromium, 7.5-10.5 nickel; for mine water and acid pump parts, marine fittings, chemical mixer and paper mill digester parts. Also resistant to heat up to 1600 degrees Fahr.

F-10; 26-28 chromium, 10-13 nickel; for heat treating furnace shafts, dampers and valves, cement kiln cooler parts, etc.; creep resistant at high temperatures; where temperature changes are not severe; and where high sulphur fuels are used.

F-12; 27-30 chromium, 7-10 nickel; same as F-10 except when sulphur is very high.

F-13; 25-28 chromium, 34-37 nickel; for temperatures up to 2100 degrees Fahr., with sulphur present.

F-14; 24-27 chromium, 19-22 nickel; for high temperatures under carburizing conditions with some sulphur present.

\- - 3 - 5 - - - - -

Nickel-manganese steel; 13-15 manganese, .70-.90 carbon, .95-1.20 silicon, 3.50-4.50 nickel; welding rod for building up and strength welding of austenitic manganese steel castings.

\- - 3 - - - - - - -

No. 459; chromium molybdenum hard alloy welding rod for hard surfacing machinery wearing parts; deposits are 500-600 brinell.

\- 2 3 - - - - - - -

No. 217; chromium-molybdenum-tungsten welding rod for hard facing cast wearing parts; extreme hardness and great wear resistance.

\- 2 3 - - - - - - -

Dieweld; a chromium-molybdenum welding rod for building up forming dies, cutting tools, punches, shear knives, etc.

\- - 3 - - - - - - -

Economy hardface; self-hardening, chromium-molybdenum-high carbon welding rod manufactured coated for alternating or direct current electric welding and bare for oxy-acetylene deposition; used for applications where extreme impact and abrasion are encountered.

1-Corrosion resistant
2-Heat resistant
3-Abrasion resistant
4-High tensile strength
5-High ductility
6-Bearing application
7-Electrical uses
8-Heat treating
9-Low specific gravity
10-Machinability

1 2 3 4 5 6 7 8 - 10
ANACONDA—American Brass Co., Waterbury, Conn. Many copper base alloys, as well as pure copper in various forms under this tradename are available, some of which are listed below.

1 - - - - - 6 - 8 - -
Beryllium Copper; copper 97.75, beryllium 2.25, nickel 0.25; abrasion resistant; high tensile strength and ductility; for springs, diaphragms, low duty bushings and bearings.

1 - - - - - - - - -
"85" Red Brass; copper 85, zinc 15; pipe tube and sheet forms; particularly resistant to salt water corrosion.

1 2 - - - - - - - -
Super-Nickel; copper 70, nickel 30; seamless tubes, sheets and plates; for severe condenser tube service and resistance to salt water corrosion.

- - - 4 - 6 - - - 10
Special Phosphor Bronze; copper 88, tin 4, zinc 4, lead 4; corrosion, heat and abrasion resistant; combines general characteristics of standard phosphor bronze alloys with free cutting qualities of yellow brass.
See advertisements, Pages 92,93

- - - - - 6 - - - -
ANFRILOY—Wellman Bronze & Aluminum Co., Cleveland. A copper-lead-tin bearing bronze for high speed, light-duty bearings and for bushings where pressure and thrust are not excessive.

1 - - 4 5 - - - - -
ANTIMONIAL ADMIRALTY—Chase Brass & Copper Co., Waterbury, Conn. Copper 71, tin 1, antimony .04, zinc 27.96. Outstanding for general corrosion resistance and particularly for preventing dezincification. Recommended for condensers in the power plant and oil industries.

- 2 - - - - - - - -
APOLLO CHROMSTEEL—Apollo Metal Works, Chicago. Cold-rolled strip, nickel-chrome-plated steel, furnished in sheets and strips for stamping into parts. Resists heat up to 800 degrees Fahr.; abrasion resistance, medium; weldability, fair. Used generally as substitute for brass and copper sheet and other critical metals when resistance to corrosion is essential or reflectivity is needed.

1 - - - - - - - - -
APOLLOY METAL—Apollo Steel Co., Apollo, Pa. Carbon .06-10, manganese .30-60, sulphur .045 max., phosphorus .04 max., copper .20 per cent min.; in sheets, for stamping and welding into parts; ult. tensile strength, 45-50 000 lb. per sq. in.; yield point 25-30,000 lb. per sq. in.; abrasion resistance, low; hardness B 40 to 50 Rockwell.

- - - 4 - - - - - -
ARISTOLOY—Copperweld Steel Co., Warren, Ohio. Full range of S.A.E. alloy steels, also aircraft, and special steels; used for gears, both light and heavy-duty, clutches, shafts and pinions; also in ball and roller bearings and aircraft parts, both for engine and plane use; stainless and nitralloy steels. Company also produces aircraft steel, stainless, nitralloy, bearing steels, and carbon and alloy tool steels.
See advertisements, Pages 106, 171

- - - - - 6 - 8 - 10
ARMASTEEL—Saginaw Malleable Iron Division, Saginaw, Mich. Carbon 2.65, silicon 1.35, manganese .4, sulphur less than .15, phosphorus, less than .1, fabricated into parts by sand casting, and also available in castings; recommended heat treatment to suit customers' requirements; tensile strength, ult., up to 100 000 lb. per sq. in.; yield point, up to 85,000 lb. per sq. in.; elongation, up to 8.0 per cent; hardness, brinell No. 163-302; Rockwell "C" up to 55 on hardening; specific gravity, 7.2; for camshafts, rocker arms, diesel pistons, refrigerator parts, crankshafts, connecting rods, etc., other automotive and diesel parts, and Hydramatic transmission parts.

1 2 3 4 5 - 7 - - -
ARMCO—American Rolling Mill Co., Middletown, O.

1 2 - 4 - - - - - -
Stainless steel, grade 18-8 (type 302, 304); 17-7 (type 301); 18-12 Mo. (type 316); 25-12 (type 309); 17 (type 430); 13 (type 410); 10-12 Mo. (type 317); 18-10 Cb. (type 347); 18-10 Ti (type 321); and 27 (type 446); these can all be drawn and stamped; all machinable, abrasion resistant and weldable.

1 - 3 4 - - - - - -
Armco High Tensile; a low alloy, high-strength. Supplied in sheets, strip and plates; suitable for stamping and welding.

- - - - - - 7 - - -
Tran-Cor 58; high silicon steel for distribution transformers. Grade 65; steel sheets with low core loss, for power and distribution transformers. Grade 72; a high silicon steel for large generators and transformers.

Intermediate Transformer; scale-free silicon steel sheet for some transformer and special applications.

Special Electric; scale-free medium steel sheet for a.c. motors and generators.

Electric; special analysis sheet for rotating machines.

Armature; steel sheet for small d.c. motors.

Field Grade; special sheet for intermittent duty fractional horsepower motors.

Radio No. 6; for applications in which superior low induction magnetic characteristics are important. No. 5; for audio transformer cores and other low induction applications. No. 4; good permeability at low induction; for chokes. Nos. 3, 2 and 1; for small transformers.

Ingot Iron; highly refined iron for magnetic cores; supplied in round and flat bar form.

1 - - - - 5 - 7 - - -
Armco Ingot Iron; highly refined iron supplied in galvanized sheet for general sheet metal work; also hot rolled annealed and cold rolled sheets, plates and strip.

- - - - 5 - - - - -
Armco Enameling Iron; highly refined iron for enameling purposes; supplied in sheets.

Armco wrought steel wheels; one-wear, two-wear, multiple wear, heat-treated and stress resistant. Long mileage and safety factors; meet all A.A.R. or special specifications. Available from 18 to 48-inch diameters.

- 2 - 4 - 6 - - - -
ASARCOLOY No. 7—American Smelting & Refining Co., New York. A cadmium-nickel bearing alloy capable of withstanding high compression loads and high operating temperatures. Nickel 1.3, balance cadmium. Furnished in ingots for spinning and permanent mold castings. Resists heat to 300 degrees Fahr.; high abrasion resistance; tensile strength, ult., 15,000 lb. per sq. in.; compressive strength, ult., 20 000 lb. per sq. in.; specific gravity, 8.7; bearing properties, good; weldability, good; brinell hardness, untreated 33; used for bearings.

- - 3 4 - - - - 8 - -
ATLAS No. 93—Allegheny-Ludlum Steel Corp., Pittsburgh. Carbon .55, chromium .65, molybdenum .35; for collets, studs and parts requiring toughness in hardened condition. Oil hardening. For use as bucket teeth, keys, pins, bolts, studs, etc.
See advertisement, Page 99

1 2 - 4 - - - - - -
AUROMET—Aurora Metal Co., Aurora, Ill., special aluminum and silicon bronzes of several compositions.

1 2 3 - - - - - - -
AVIALITE—American Brass Co., Waterbury, Conn. Copper-aluminum alloy for valve seats and guides in airplane motors.
See advertisements, Pages 92-93

- 2 - - - - - - - -
"AW" (rolled steel floor plate)—Alan Wood Steel Co., Conshohocken, Pa. Furnished in five patterns to meet flooring problems in the industrial and transportation fields; designed to withstand heaviest traffic; oilproof, crackproof, heatproof, slipproof, and noiseless. Furnished in carbon, copper or alloy analysis; also available in other nonferrous metals.

1 - - 4 - - - - - -
"AW" DYN-EL—Alan Wood Steel Co., Conshohocken, Pa. Furnished in sheets, strips, and plates, for stamping, welding, cold forming and hot forming, etc.; abrasion resistance medium; tensile strength 70-80,000 lb. per sq. in.; ductility high; weldability good; fatigue and impact values high; for structures requiring high strength.

1 2 - - - - - - - -
B & W CROLOY—Babcock & Wilcox Tube Co., Beaver Falls, Pa.

2; carbon .15 max., chromium 1.75-2.25, molybdenum .45-.65, silicon .5 max.; for refinery and superheater tubes. Corrosion resistant and heat resistant at nominal temperatures.

2¼; carbon .15 max., chromium 2-2.5, molybdenum .9-1.1, silicon .5 max.; for refinery and superheater tubes where exceptionally high creep strength is required.

5; chromium molybdenum; carbon .15 max., chromium 4-6, molybdenum .45-.65; for oil refinery service.

7; carbon .15 max., chromium 6-8, molybdenum .45-.65 for oil refinery service where increased corrosion resistance is required.

9; carbon .15 max., chromium 8-10, molybdenum 1.2 min.; semistainless alloy of good physical properties and corrosion resistance.

12 (type 410); carbon .15 max., chromium 12-14; resistant to atmosphere and acids; resists heat to 1500 degrees Fahr. and when heat treated has tensile strength of 180,000 lb. per sq. in.

18 (type 430); carbon .12 max., chromium 15-18; useful for certain elevated temperature applications but particularly for nitric acid plant equipment.

18-8S (type 304); carbon .08 max., chromium 18-20, nickel 8-11; low carbon; for high temperature work or corrosion resistant service.

16-13-8 (type 316); carbon .1 max., manganese 2 max., chromium 16-18, nickel 11-14; molybdenum 2-3; austenitic type alloy similar in many respects to 18-8S and 25-20; high strength at elevated temperatures; corrosion resistant.

25-20 (type 310); chromium 25, nickel 20; high strength and high oxidation resistance; also excellent corrosion resistance.

27 (type 446); carbon .2 max., chromium 26-30, resistant to oxidation to 2100 degrees Fahr.; also corrosion resistant.
See advertisement, Page 118

B

1 2 - - - - 7 - - -
BAKER—Baker & Co. Inc., Newark, N. J. Platinum and alloys for linings, contacts, thermocouples, furnace resistors, etc.

- - - - - 6 - - - -
BEARITE—A. W. Cadman Mfg. Co., Pittsburgh; babbitt metal furnished in ingots and 50-pound pigs; brinell hardness at 70 degrees Fahr. 29.1, 212 degrees Fahr. 24.4; compressive strength 15,000 lb. per sq. in.; for rotary bearings subjected to heavy loads and extreme speed.

- - - - - 6 - - - -
BECKETT METAL—Beckett Bronze Co., Muncie, Ind. Several grades of high lead bronze; copper 60-75, tin 3-9, lead 16-35, and nickel 0-1; furnished in rough bars and rods (cored or solid) for turning, boring, etc., resists corrosion due to sulphuric-hydrochloric acid solutions, and resistant to heat to 400 deg. Fahr.; tensile strength 21-24,000 lb. per sq. in.; good bearing properties; brinell hardness, untreated, 38-46; used for bearings, bushings, and to a limited extent in seals, piston rings and gears.

- - - 4 5 - - - - -
BELECTRIC—Belle City Malleable Iron Co., Racine, Wis. Furnished as sand castings; tensile strength 35-60 000 lb. per sq. in.; high compressive strength; good bearing properties: recommended heat treatments are the same as for standard gray iron; brinell hardness, untreated 179-285, heat treated 300-550; used where rigidity, wear-

1—Corrosion resistant | 2—Heat resistant | 3—Abrasion resistant | 4—High tensile strength | 5—High ductility | 6—Bearing application | 7—Electrical uses | 8—Heat treating | 9—Low specific gravity | 10—Machinability

ability or where strong high grade gray iron might be applied.

- - - 4 5 - - - - - 10
BELECTROMAL—Belle City Malleable Iron Co. Racine, Wis. High strength malleable iron furnished as sand castings; tensile strength 60-70,000 lb. per sq. in.; high ductility; brinell hardness, untreated 140-170; recommended for castings for automotive, railroad, tractor and implement work.

- - - - 5 - - - - -
BELMALLOY—Belle City Malleable Iron Co., Racine, Wis. Pearlitic malleable iron, electric furnace melted and continuous oven annealed; tensile strength, 70,000 lb. per sq. in. min.; yield point, 45,000 lb. per sq. in. min.; elongation, 5 per cent min.; and brinell hardness, 179-217. Used for castings of machining quality requiring strength and shock resistance.

- - - - - - - - - 10
BERALOY No. 25—Wilbur B. Driver Co., Newark, N. J. Beryllium-copper alloy; copper 97.75, beryllium 2, and cobalt .25; furnished in soft annealed state or in slightly cold-worked conditions for easy machining and forming into parts. Tensile strength of 66,000 lb. per sq. in. in annealed state can be increased to 175,000 lb. per sq. in. by simple hardening treatment at 600 degrees Fahr., and by cold work after solution anneal. tensile strength can be increased to 200,000 lb. per sq. in. Used for electrical spring parts, contacts, switch jaws, diaphragms, switch parts, bearings, connectors, valves, cams, etc.

1 - - - - - - - - -
BERMAX BABBITT—Federal Mogul Corp., Detroit. A high lead babbitt; easy to use, cast and easy to handle in rebabbitting; melting point slightly higher than that of tin-base metals and can be cast by any method without fear of segregation; for use as bearing lining.

1 - - - - - - - - -
BETH-CU-LOY—Bethlehem Steel Co., Bethlehem, Pa. A copper bearing steel resistant to atmospheric corrosion; for jackets, covers, machine guards, oil pans, etc.

- - 3 - - - 7 - - -
BETHLEHEM—Bethlehem Steel Co., Bethlehem, Pa.

No. 235; abrasion-resistant, high-carbon-manganese-silicon steel of 235 brinell; for shovels, crushers, hoppers, scraper blades and conveyors.

1 - - - - - - - - -
BETHLEHEM 88-80—Bethlehem Steel Co., Bethlehem, Pa. Chromium-molybdenum steel castings with high abrasion resistance for ball mill liners, rolls, tires, bottom plates, etc.

- - - - - 6 - - - -
BETHLEHEM Bearing Steels—Bethlehem Steel Co., Bethlehem, Pa. Standard high-carbon high-chromium ("52-100" type) for ball bearings and low-carbon nickel-molybdenum type for roller bearings. All grades can be processed to meet the requirements of automotive and industrial service.

- - - - - - 7 - - -
BETHLEHEM Magnet Steels—Bethlehem Steel Co., Bethlehem, Pa. High-carbon steels with varying chromium content, up to 6 per cent.

1 2 - - - - - - - -
BISHOP STAINLESS—J. Bishop & Co., Platinum Works, Malvern, Pa. A stainless steel seamless tubing; heat and corrosion-resistant; furnished in a large number of diameter and gage combinations. Mechanical tubing class comprises large group of sizes and uses, from tiny tubing 1/100 in. outside diameter for fine instruments to ¾-inch ⅞ or 1-inch sizes for condensers, dairy equipment, heat exchangers, chemical plant equipment etc. Capillary tubing has very small bore in relation to outside diameter, produced in long lengths and in a variety of sizes. Hypodermic needle tubing; available in range from 33-11 Stubbs gage having appropriate wall thickness and held within close tolerances.

- - - - - - - - 9 -
BOHNALITE—Bohn Aluminum & Brass Corp., Detroit. Light alloy of which aluminum is the base; for forged connecting rods, cast cylinder heads, crankcases, transmission cases, and parts for vacuum cleaners, washing machines, shoe machinery, etc.

- - 3 - - - - - - -
BORIUM—Stoody Co., Whittier, Calif. Tungsten carbide metal used chiefly as inserts in rotary drilling tools as substitute for diamonds.

Tube Borium and Borod; made up of steel tubing containing fine particles of Borium; used as overlays on earth working equipment.

- - - - - 6 - - - -
BOUND BROOK—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J. Bushings, bearings and washers; cast bronze inlaid with hard graphite lubricant in grooves or holes of various designs; particularly adaptable to high temperatures, severe static loads, immersion in liquids, exposure to dusts or where oils are objectionable.

See advertisement, Page 183

1 - - - 5 - - - - -
BRASSOID—American Nickeloid Co., Peru, Ill. Brass bonded to zinc, latter serving as rust-proof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum adhered paper covering permitting drawing and forming without marring pre-finish.

1 - - - 5 - - - - -
BRIDGEPORT COPPER AND ZINC ALLOYS—Bridgeport Brass Co., Bridgeport, Conn.

Yellow brass; copper 65, zinc, 35, copper 70, zinc 30; sheet, wire and seamless tubing for drawing, stamping, and cold heading.

Cartridge brass; copper 70, zinc 30. Sheet for making small arms ammunition and artillery cartridge cases.

Free-cutting brass rod; copper 60, lead 3, balance zinc; for making automatic screw machine parts.

Forging rod-copper 60, lead 2, balance zinc,

Low brass; copper 80, zinc 20; pale golden color; for articles requiring greater ductility and malleability than possessed by yellow brass.

Commercial bronze; copper 90, zinc 10; bronze color for manufacturing stampings and drawn items and cold headed items, for outdoor use; stands weathering better than yellow brass; copper sheet, rod, wire, seamless tubing for miscellaneous manufacturing. Leaded brass alloys, containing from ¼-3.75 per cent lead to facilitate machining.

Phosphor-bronze; copper 92, tin 8; for spring parts; has better spring properties than lower tin content.

Bronze welding rods in a variety of alloys for brazing iron and steel gears, frames, and other broken machine parts; for welding silicon bronze tanks.

1 - - 4 - - - - - -
Phosphor-bronze; copper 95, tin 5; sheet spring quality for manufacturing switch parts.

Copper in form of sheet and tube for fabricating.

1 2 - - 5 - - - - -
BRIDGEPORT TUBING—Bridgeport Brass Co., Bridgeport, Conn.

Condenser tubing; Available in Admiralty metal for sea water, Cuzinal (aluminum brass) for harbor water, Muntz metal for fresh water, Duronze IV for aerated brackish water, Cupro-Nickel for most severe service and U. S. Navy requirements, and Arsenical copper for resisting corrosion better than straight copper.

Duplex tubing; for two different types of corrosion inside and outside of tubing which are too severe for a single alloy. Steel, stainless steel, aluminum on outside or inside in combination with Admiralty brass, aluminum brass, copper or cupro nickel, used for oil refining, refrigeration systems, chemical plants and food processing.

Copper water tubing; for industrial applications, and for pipe lines on board ship.

1 2 3 - - - - - - -
BUFFALO Wire Cloth—Buffalo Wire Works Co. Inc., Buffalo, N. Y. Wire cloth for every industrial use; screens for abrasive material, chemicals and powder in plain steel, tinned, brass, copper, bronze, monel and stainless steel; also galvanized after woven wire cloth.

See advertisement, Page 101

- - - - - 6 - - - -
BUNTING—The Bunting Brass & Bronze Co., Toledo, O. Over 1000 sizes of standardized completely finished stock bearings for machinery applications; also special sizes made to blueprint specifications from SAE, ASTM and other standard analyses including the following:

No. 27; copper 80, tin 10 and lead 10.

No. 51; copper 86, tin 10, lead 1.5 and zinc 2.

No. 72; copper 83, tin 7, lead 7 and zinc 3.

No. 96; copper 87.5; tin 10 and lead 2.5.

No. 98; copper 88, tin 10 and zinc 2.

No. 124; copper 85, tin 5, lead 9 and zinc 1.

No. 125; copper 75, tin 4.5 and lead 20.5.

No. 135; copper 77, tin 8 and lead 15.

No. 156; copper 89 and tin 11.

No. 164; copper 70, tin 5 and lead 25.

No. 178; copper 68, tin 4 and lead 28.

Babbitt metals.

Precision machined bearings, bushings, solid and cored bars from stock. All cast in accordance with SAE bearing bronze specification No. 660.

Aviation and machine tool bearings and transmission cones are sand, chilled or centrifugally cast and machined to the finest chemical and physical tolerances.

See advertisement, Page 111

C

1 - - 4 5 - - - - -
CMP STRIP—The Cold Metal Products Co., Youngstown, O. Precision cold-rolled strip steel, carbon and alloy grades; in any gage .001-inch or heavier. All standard tempers and finishes.

See advertisement, Page 86

1 2 3 - - - - - - -
CARBOLOY—Carboloy Co. Inc., Detroit. A series of cemented carbides basically made from tungsten carbide and a softer cementing element such as cobalt. In certain grades, supplementary ingredients are the carbides of tantalum, titanium or other metals. Has high resistance to abrasive and corrosive wear; outstanding on account of its extreme hardness, compressive strength being as high as 800,000 lb. per sq. in.; tensile strength, 100-200,000 lb. per sq. in.; Rockwell hardness on "A" scale 86-93; does not rust or corrode under normal conditions. Recommended as wear resistant inserts for machine parts subject to extreme wear such as cams, cam followers, hydraulic valve stems and seats, machine tool rests, etc.

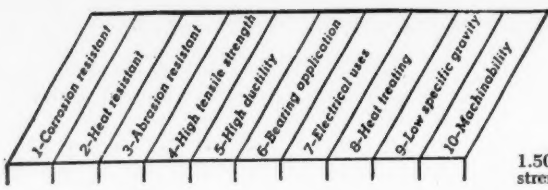
- - 3 - - - - - - -
CARBOMANG—Detroit Alloy Steel Co., Detroit. Furnished as castings. Carbon .90-1.00, manganese 1.00-1.10, chromium .40-.60; medium abrasion; tensile strength, ult., 125,000 lb. per sq. in.; compressive strength, ult., 200,-000 lb. per sq. in.; medium ductility; brinell hardness, untreated 200, heat treated 600; for air-hardening tool steel castings.

1 2 3 4 5 6 7 - - -
CARPENTER—The Carpenter Steel Co., Reading, Pa.

1 - 3 4 - - - - - -
Stainless No. 2; carbon .3; chromium 13; used in fully hardened condition for ball bearings, ball check valves, balls, instruments, etc.

Stainless No. 2B; carbon 1, chromium 17; uses same as No. 2 used for hardened balls, valve seats, etc.

1 2 - 4 - - - - - -
Stainless No. 3; carbon .15, chromium 20,



copper 1; for special chemical apparatus and scale resisting parts, stampings and moldings.

1 2 - 4 - - - - - -

Stainless No. 4; carbon .1, chromium 18, nickel 8; for rolled moldings, stampings, wire parts, tubing, etc.; also has high ductility.

Stainless No. 5; carbon .1, chromium 13.5, sulphur .30; a free-machining grade for automatic screw machine parts, valve trim, pump shafts, etc. Is heat resistant.

1 - - - 5 - - - - -

Stainless No. 6; carbon .1, chromium 17; uses same as No. 1 and No. 4—stampings, wire parts and moldings.

1 - 3 - - 6 - - - -

Stainless No. 8; carbon .1, chromium 18, nickel 8, selenium .25; a free-machining grade; heat-resistant; screw machine work.

- - 3 - - 6 - - - -

Presto; carbon 1.05, chromium 1.4; for ball and roller bearings.

- - - 4 - - - - - -

Silico-manganese steel; carbon .6, manganese .75, silicon 2; for heavy-duty springs.

- - 3 4 - - - - - -

No. 5-317; chrome-nickel steel; carbon .5, nickel 1.75, chromium 1; for gears, clutches and shafts.

No. 5 Samson; carbon .5, nickel 1.25, chromium .6; for gears and clutches.

No. 4-408; carbon .4, nickel 3, chromium .75; for clutches and shafts.

- - 3 4 5 - - - - -

No. 158; carbon .1, nickel 3.5, chromium 1.5; for case-hardened high-duty clash gears, shafts and clutch parts.

- - 3 - 5 - - - - -

No. 2 Samson; carbon .2, nickel 1.25, chromium .6; for case-hardened gears, roller bearings, pneumatic tool parts, etc.

- - 3 4 - - - - - -

No. 4 Samson steel; carbon .4, nickel 1.25, chromium .6; for side links of silent chains, shafts, axles, etc.

- - 3 4 - - - - - -

No. 3-547; nickel-steel; carbon .3, nickel 3.5; for heat-treated shafts, etc.

- - 3 - 5 - - - - -

No. 2-547; case-hardening nickel-steel; carbon .2, nickel 3.5; for small parts requiring hard surface and tough core.

No. 500; carbon .1, nickel 5; for turbine blades, case-hardened gears, etc.

- - 3 4 - - - - - -

Chrome-vanadium 5-720; carbon 5, chromium .9, vanadium .2; for leaf and coil springs, gears, shafts, etc.

No. 3-427 chrome-molybdenum-steel; carbon .3, chromium 1, molybdenum .2; for aircraft and automotive parts.

- - 3 - 5 - - - - -

No. 436; carbon .15, nickel 1.75, molybdenum .25; for case-hardened parts.

- - - - - - 7 - - -

Temperature compensator alloy; iron-nickel alloy; furnished in rough bars or billets, finished rods or bars, wire and strips for hot forging, stamping, turning, boring, etc.; permeability varies inversely as temperature; for magnetic shunts for meters, speedometers, tachometers, voltage regulators, etc.

See advertisements, Pages 96-97

- - 3 4 - - - 8 - -

CAST ALLOY STEEL—The Alloy Cast Steel Co., Marion, O.

- - - 4 - - - - - -

Nickel-steel castings; carbon .30-.40, manganese .60-.80, sulphur .05 max., phosphorus .045 max., silicon .35-.45, nickel 3.25-3.75, has high strength and resistance to shock and fatigue; used largely in annealed condition, although responds to heat treatment.

- - 3 4 - - - - - -

Nickel-chrome-steel castings; carbon .35-.45, manganese .60-.80, phosphorus .045 max., sulphur .05 max., silicon .35-.45, nickel 1.50-2.00, chromium .60-.75; has high strength and wear resistance.

- - 3 4 - - - 8 - -

Nickel-chrome-molybdenum-steel castings; carbon .35-.45, manganese .60-.80, phosphorus .045 max., sulphur .050 max., silicon .35-.45, nickel 1.50-2.00, chromium .60-.75, molybdenum .25-.45; used in parts which must be strong and hard and where size or shape prevent liquid quenching.

- - 3 4 - - - 8 - -

Manganese-molybdenum-steel castings; carbon .30-.40, manganese 1.25-1.60, phosphorus .045 max., sulphur .050 max., silicon .35-.45, molybdenum .25-.45; used for gears, sprockets, levers, etc.

- - 3 4 - - - - - -

Medium manganese-steel castings; carbon .30-.40, manganese 1.25-1.50, phosphorus .045 max., sulphur .050 max., silicon .35-.45; used in power shovels, tractors, road machinery, etc.

High-manganese-steel castings; carbon 1.10-1.30, manganese 10.50-13.50, phosphorus 10 and under; tensile strength, 80-90,000 lb. per sq. in.; yield, 40-50,000; cannot be machined readily and is finished by grinding.

- - - 4 - - - - - -

CASTOLIN—Eutectic Welding Alloys Inc., New York. Low temperature welding alloys, bind without melting base metal; high strength; matching color; less stresses; less warping; less preheating. Welds steel of all analyses, stainless, cast iron, malleable iron, cast steel, bronze brass, copper, aluminum and alloys, magnesium and alloys, nickel and alloys. Company also produces alloy welding rods, Castolin in Autochemic Flux.

See advertisement, Page 193

1 - 3 - - 6 - - - -

CASTOLOY—Detroit Alloy Steel Co., Detroit, Furnished as castings. Chromium 12-14, carbon 1.5-1.6, cobalt .70, molybdenum .85; semiresistant; heat resistant to 1000 degrees Fahr.; medium abrasion resistance; tensile strength, ult., 100,000 lb. per sq. in.; compressive strength, ult., 350,000 lb. per sq. in.; medium ductility; good bearing and magnetic properties; used for bearings, cams, valve seats and spindles.

- - 3 4 - 6 - - - -

CECOLLOY—Chambersburg Engineering Co., Chambersburg, Pa.

- - 3 4 - - - - - -

A; carbon 3.00; molybdenum .50, nickel .60; shock resistance, vibration damping and close grain.

B; carbon 2.80, molybdenum .50, chromium .35; also has shock resistance, is vibration damping and has close grain in heavy sections.

- - 3 4 - 6 - - - -

C; carbon 3.00, molybdenum .50; nickel 1.50, properties similar to type A.

1 - - 4 - 6 - - - -

CECOLLOY IRON—Chambersburg Engineering Co., Chambersburg, Pa.; carbon 3, manganese .90, silicon 1.30, nickel .60, molybdenum .50; suitable for casting in cement-bonded sand molds; resists corrosion to atmospheric conditions and acids; has tensile strength 56,000 lb. per sq. in.; brinell hardness of 255; for steam cylinder liners, cylinders, rings and valves; also beds for heavy-duty machine tools.

CERROBASE—Cerro de Pasco Copper Corp., New York. Bismuth-lead casting alloy which expands on cooling; melts at 255 degrees Fahr.; tensile strength 6100 lb. per sq. in.; recommended for master patterns, electroforming, engraving machine models, etc.

CERROBEND—Cerro de Pasco Copper Corp., New York. Bismuth-lead-tin-cadmium casting alloy which expands on cooling and has the extremely low melting temperature of 160 degrees Fahr.; tensile strength of 6000 lb. per sq. in.; useful as a fusible alloy and as a filler for tube bending.

CERROMATRIX—Cerro de Pasco Copper Corp., New York. Bismuth-lead-tin-antimony casting alloy which melts at 248 degrees Fahr. and expands on cooling; tensile strength 13,000 lb. per sq. in.; used for locating and anchoring machine parts in cored holes.

- 2 - - - - 7 8 - -

CHACE THERMOSTATIC BIMETAL—W. M. Chace Co., Detroit. Thermostatic bimetals; a number of combinations including alloys of nickel-iron, nickel-iron-chromium, nickel-iron-manganese, pure nickel, brass, bronze, etc.; responsive to various temperature ranges and provide a wide range of deflection rates and electrical resistivities; for temperature control elements in controllers, recorders, indicators, circuit breakers, etc.

See advertisement, Page 185

1 - - 4 5 - - - - -

CHAMET BRONZE—Chase Brass & Copper Co., Waterbury, Conn.

Type A; copper 60, tin .75, zinc 39.24; for shafting and structural and engineering uses.
Type B; copper 62, tin .65, zinc 37.35; for general cold heading and upsetting purposes.

1 - - 4 5 - - - - -

CHASE—Chase Brass & Copper Co., Waterbury, Conn.

1 - - 4 5 - - - - -

Cupro-Nickel; copper 70, nickel 30; largely used for condenser tubes particularly for extreme service in very corrosive waters.

1 - - - - - - - - -

Free-cutting commercial bronze; copper 89, lead 2, zinc 9; for screw machine parts requiring good physical properties and high corrosion resistance.

Also various high and low brasses and bronzes in various forms to meet specific requirements for a variety of mechanical parts.

1 - - - - - 7 8 - 10

CHASE TELLURIUM COPPER—Chase Brass & Copper Co., Waterbury, Conn.

1 - - - - - - - - 10

Type A; copper 99.5, tellurium .5; furnished in finished rods or bars and tubing for hot forging, extruding, turning, boring, etc.; corrosion resistant; resists heat up to 450 degrees Fahr.; medium abrasion resistance; tensile strength 32-55,000 lb. per sq. in.; medium ductility; brinell hardness, untreated 90; for electrical connections, parts for electric motors, switches, etc.

1 - - - - - - 8 - 10

Type B; copper 98.3, nickel 1, tellurium .5 and phosphorus .2; resists heat up to 450 degrees Fahr., medium abrasion resistance; tensile strength 40-70,000 lb. per sq. in.; specific gravity, .323 lb. per cu. in.; brinell hardness, untreated 50, heat treated 125; for marine hardware, locks and bolts, etc.

1 - - - 5 - - - - -

CHROMALOID—American Nickeloid Co., Peru, Ill. Chromium bonded to nickel-bonded zinc, latter serving as rust proof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum adhered paper covering permitting drawing and forming without marring pre-finish.

- 2 - - - - 7 8 - -

CHROMEL—Hoskins Mfg. Co., Detroit.

Alloy 502; nickel 35, chromium 18½, balance mainly iron; supplied as castings, or as rod bars, and strips. For general heat resistant applications and for mechanical and load-carrying members which are heated to 2000 degrees Fahr.

Alloy 670; chromium 25, nickel 12, balance mainly iron; supplied as castings or as rod, bars and strips; for high temperature applications where sulphur corrosion must be withstood.

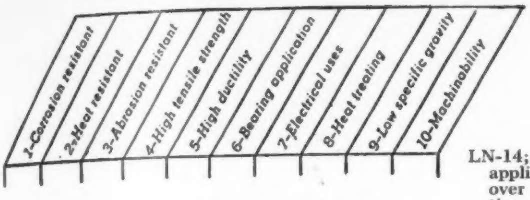
Grade A; nickel 80, chromium 20, supplied as castings or as rod, bars, wire and strip; used for electric heating elements up to 2100 degrees Fahr.

Grade C; nickel 60, chromium 16, balance mainly iron; used for electric heating elements to 1700 degrees Fahr.; also used for rheostatic purposes; supplied as castings, or as rods, bars and strip.

Grade D; nickel 35, chromium 18½, balance mainly iron; used for heating elements to 1400 degrees Fahr.; available cast, or as wire, rod and strip.

- - 3 4 - - - - - -

CHROMEWELD 4-6—Lincoln Electric Co., Cleveland. For the welding of steels commonly known as 5 per cent chromium steels. Annealed at 1550-1600 degrees Fahr.; cooled slowly and stress relieved at 1400



degrees Fahr. will have tensile strength of 80-90,000 lb. per sq. in.; yield point 55-65,000 lb. per sq. in.; elong. in 2 in., 24-30 per cent; reduction in area 60-70 per cent; brinell hardness, 155-175.

1 2 3 4 5 - - - - -

CIRCLE L—Lebanon Steel Foundry, Lebanon, Pa. This tradename covers castings in forty-three different types of alloys including the following:

- - - 4 5 - - - - -

No. 1; manganese 1.40, carbon .35, with vanadium or molybdenum.

- - 3 4 5 - - - - -

No. 2; carbon .32, chromium .75, molybdenum .30, manganese 1.40; for crankshafts, airplane parts, valves and other castings.

- - 3 4 - - - - - -

No. 3; carbon .40, chromium 1.25, vanadium .12, molybdenum .40, manganese .75, for gears and cams, and nitrided parts.

No. 5; carbon .30, chromium .75, nickel 1.75; molybdenum .30; for highly stressed parts.

No. 6; carbon .15, nickel 1.75, molybdenum .25; for cams, gears and other case hardened parts (carburizing).

No. 9; carbon .25, molybdenum .45; for parts subject to temperature.

1 2 - 4 - - - - - -

No. 10; carbon .20, chromium 5.50, molybdenum .55; for high pressure and high temperature applications in the oil industry.

1 - 3 - - - - - - -

No. 11; carbon .25, chromium 18; stainless steel; for parts subject to nitric acid corrosion.

1 - - - - - - - - -

No. 12; carbon .10, chromium 13; stainless steel; for chemical apparatus, etc.
No. 13; carbon .25, chromium 13; for stainless steel parts where high hardness is essential.

1 2 - - - - - - - -

No. 15; carbon .30, chromium 27; heat and corrosion service.

No. 22; carbon .07 max., chromium 19.0, nickel 9; for miscellaneous stainless parts and castings to be polished. Also made with molybdenum and/or columbium as required.

No. 23; carbon .15, chromium 19.0, nickel 9; miscellaneous stainless alloy castings.

No. 30; carbon .15, chromium 24, nickel 12; for valves, pumps and miscellaneous parts for the paper industry.

No. 31; carbon .22, chromium 28, nickel 11; resistant to temperatures up to 2000 degrees Fahr.

No. 32; carbon .50, chromium 15, nickel 35; heat resisting castings requiring strength at elevated temperatures.

No. 34; carbon .06, chromium 20, nickel 30, molybdenum 3, plus copper.

- - 3 - - 6 7 - - -

CLETALOY—Cleveland Tungsten Inc., Cleveland. Copper-tungsten type electrode for spotwelding. Available in four grades with high specific gravity.

CT-A; predominantly tungsten; hardness of 92-97 Rockwell B with an electrical conductivity about 38 per cent that of pure copper. In addition to spot-welding, it works well as crimper die insert for finish turning edge of steel jacket to form a seal for the porcelain stem in spark plugs.

CT-65; conductivity and tungsten similar to that of CT-A grade; hardness of 84-91 Rockwell B. For welding of thin stainless steel sheets, and in the upsetting of special steel which does not forge well, this grade supplies red hot surface which can withstand high pressure of small bar during knob-forming process. This grade holds original hardness especially well.

CT-86; has a higher electrical conductivity than other grades, with a Rockwell B hardness of 77-83; suitable for welding nonferrous metals and for applications where low pressures are sufficient.

LN-14; silver tungsten base alloy for use in applications where it shows an advantage over copper, possibly having some connection with the fact that silver oxide which might form on surface is a better electrical conductor than copper oxide.

1 - 3 - - - - - - 10

COBALTCROM-PRK-33—Darwin & Milner Inc., Cleveland. Carbon 1.4, chromium 13, cobalt 3.3, manganese .3, silicon .6, molybdenum .6; in rough bars or billets and finished rods or bars, for hot forgings, turning, boring, etc. Mechanical properties in heat-treated state are ult. tensile strength, 200,000 lb. per sq. in.; compressive strength. 226,000 lb. per sq. in.; yield point, 70-80,000 lb. per sq. in.; impact resistance, low; hardness, up to 63 Rockwell C; specific gravity, 10 per cent below that of tungsten high-speed steel; heat-resistant to 1500 degrees Fahr.; abrasion resistance, high; for valves in aeroplanes and tanks.

1 - - - - - - - - -

COLORSTRIP—Acme Steel Co., Chicago. Strip steel, electro-galvanized and coated on one or both sides with any specific color (coating may be either enamel or lacquer); furnished in coils and can be fabricated by rolling or stamping; corrosion resistant; resists heat up to 150 degrees Fahr.; same tensile strength, elongation and hardness as any strip steel with slight variations depending on temper and analysis of the base metal.

- - - 4 5 6 - - - -

COLUMBIA—Columbia Steel & Shafting Co., Pittsburgh; furnished in rods and bars, tensile strength is high; bearing properties good; material machines freely.

- - - - - 6 - - - -

COMMERCIAL—Buckeye Brass & Mfg. Co., Cleveland. Cored and solid bronze bars; copper 80, tin 10, lead 10; for bushings, bearings and bars.

See advertisement, Page 101

- - - - - 6 - - - -

COMPO—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J. Oil-retaining porous bronze bearings and washers; copper 88.75, tin 9.75, graphite 1.5; porous structure containing as high as 35 per cent of oil or other lubricant by volume. Made to Army, Navy and Air Corps Specifications for gun mounts, airplane engines and chassis, machine tools, electric motors, automobiles, etc.

See advertisement, Page 183

1 - - - - - - - - -

CONTINENTAL SUPER STEEL — Continental Roll & Steel Foundry Co., East Chicago, Ind. Chrome-nickel-molybdenum rolling mill rolls for billet, blooming, merchant and bar mills.

See advertisement, Page 167

- 2 - - - 6 7 - - -

COPEL—Hoskins Mfg. Co., Detroit. Copper 55, nickel 45; used mostly for thermostatic and electrical resistance purposes, also for heating elements to 800 degrees Fahr. Temperature coefficient of resistance is practically nil.

1 - - - 5 - - - - -

COPPEROID—American Nickeloid Co., Peru, Ill. Copper bonded to zinc, latter serving as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for use in continuous feed automatic presses. Can be supplied with quick removable gum adhered paper covering permitting drawing and forming operations without marring pre-finish.

1 - - - - - 7 - - -

COPPERWELD—Copperweld Steel Co., Glassport, Pa. Copper-covered steel in steel wire or rod, with copper exterior permanently welded (cast) to the steel core; resists rust and corrosion; provides adequate electrical conductivity for many electrical uses and rust-resisting high strength for many mechanical uses. In its Warren, O. plant the company also produces aircraft steels, stainless steels, Nitralloy steels, bearing steel, and carbon and alloy tool steels.

See advertisements, Pages 166, 171

- - - - - 6 - - - -

COPREX—Neveroil Bearing Co., Wakefield, Mass. A series of ten bronze alloys furnished in bearings, has about same weight and strength as cast bronze, while density ranges from hard to softer or more porous types.

- - 3 - - 6 - - - -

CRAMP ALLOYS—Cramp Brass & Iron Foundries Division Baldwin Locomotive Works, Philadelphia.

No. 49; furnished in rough bars or billets, rods or bars, and sand castings; resists heat to 400 degrees Fahr.; high abrasion resistance; tensile strength 120,000 lb. per sq. in.; compressive strength 55,000; medium ductility; specific gravity, 6.8; good bearing properties; used for heavy-duty, slow-moving loads.

No. 99; furnished in rough bars or billets and rods or bars; resists corrosion by sulphuric, sulphurous, acetic acids; heat-resistant to 450 degrees Fahr.; high abrasion resistance; tensile strength 55,000 lb. per sq. in.; compressive strength 22,000; good bearing properties; brinell hardness, untreated 100; used for high-speed bearings and acid-resisting parts.

- - 3 - - - - - - -

CRASFLOY—Continental Roll & Steel Foundry Co., East Chicago, Ind. Hard alloy grain iron rolling mill rolls made in four grades: mild, medium, hard and super hard.

See advertisement, Page 167

- 2 - - - - - - - -

CUFERCO—Westinghouse Electric & Mfg. Co., East Pittsburgh. Copper-iron-cobalt alloy resembling Cupaloy, but has greater strength, higher heat resistivity, more mechanical endurance, and somewhat lower electrical conductivity.

1 - - 4 - - 7 - - -

CUPALOY—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Copper base alloy containing chromium and silver; thermal and electrical conductivity 80-90 per cent pure copper; tensile properties of steel; brinell hardness of 140-160; applications include spot-welding tips, seam-welding wheels and rolls, mechanical parts carrying heavy current, etc. Licensee: A. W. Cadman Mfg. Co., Pittsburgh.

1 2 - - - - 7 - - -

CUPRON—Wilbur B. Driver Co., Newark, N. J. Copper 55, nickel 45; in rough bars or billets, finished rods or bars, wire and coiled strips. Mechanical properties in untreated state: ult. tensile strength, 62,000 lb. per sq. in.; percent elongation, hard 2—soft 40; specific gravity, 8.9; nonmagnetic; weldability, good; heat-resistant to 1500 degrees Fahr.; abrasion resistance, high; for electrical uses.

D

- - 3 4 - - - - - -

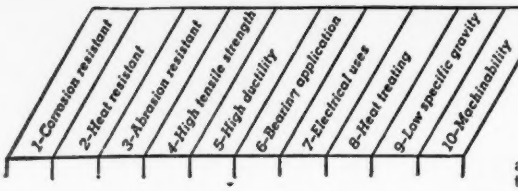
D-H-S BRONZE—Koppers Co., Bartlett Hayward Div., Baltimore. In rough bars or billets, rods or bars, also as sand castings; zinc 21-25, copper 61-65, hardener (aluminum, manganese and iron) 13-15; resists corrosion, heat-resistant to 400 degrees Fahr.; high abrasion resistance; tensile strength, 100-130,000 lb. per sq. in.; compressive strength 90,000; specific gravity .278 lb. per cu. in.; nonmagnetic; brinell hardness, untreated 200-240; for heavy-duty bearings, gears, guides, screws, stems, nuts, etc.

- 2 - 4 - - - 8 - -

DM-45—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon .4-.5; manganese .4-.7, silicon .5-.8, chromium 1-1.5, molybdenum .45-.65; furnished in rough bars or billets, and finished rods or bars, for hot forging, turning, boring, etc., into parts. Resists heat to 1100 degrees Fahr.; tensile strength, 150,000 lb. per sq. in., min., heat treated; medium ductility; and brinell hardness, untreated 185, heat treated 411 max. For bolts, studs and other highly-stressed parts used at elevated temperatures.

1 2 - - - - - 8 - -

DM STEEL—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon .15 max., manganese .3-.6, silicon .5-1, chrome 1-1.5, molybdenum .45-.65, phosphorus .03 max., sulphur .03 max.;



furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc. into parts. Resists heat to 1100 degrees Fahr., tensile strength, ult., 60,000 lb. per sq. in., min.; medium ductility; fair weldability; and brinell hardness, annealed 163 max. Used for oil refinery field.

1 - - - - - - - - 10
DAIRYWHITE—Arthur Harris & Co., Chicago. Copper-nickel of varied proportions used for food processing equipment and dairy industry; furnished as sand castings; corrosion-resistant; easily machinable.

- - - - 5 6 - - - -
DEFENDER METAL—Magnolia Metal Co., Elizabeth, N. J. Lead-tin-antimony alloy furnished in ingots, as substitutes for tin-base babbitts. Mechanical properties in untreated state: ult. tensile strength, 16,000 lb. per sq. in.; yield point 7685; impact resistance, medium; hardness, 20 brinell; resists corrosion caused by lubricating oils; abrasion resistance, medium; used for internal combustion engines, trap rock crushers and sifter machinery.

1 2 - 4 - - - - - -
DEFIHEAT—Rustless Iron & Steel Corp., Baltimore. No. 446 stainless type carbon .35 max., chromium 23 to 30; resists nitric and sulphuric acids, also heat to 2000 degrees Fahr.; for furnace parts and other applications involving high heat.

1 2 - 4 - - - - - -
DEFIRUST—Rustless Iron & Steel Corp., Baltimore.

No. 410 stainless type; carbon .15 max., chromium 10-14; hardening type of stainless steel for turbine blades.

No. 416 machining type; carbon .15 max., sulphur .15 and chromium 12-14; hardening type of stainless steel possessing free-cutting properties.

1 2 3 4 - - - - - -
DEFISTAIN—Rustless Iron & Steel Corp., Baltimore.

Types 302, 304 and 308; carbon .08-.12 max. or .08 max., manganese 2 max., chromium 18-22, nickel 8-12; retains high tensile strength and resistance to creep to 1300 degrees Fahr.; nonmagnetic; resists nitric acid, salt air, and food; resists heat to 1600 degrees Fahr.; recommended for machine parts which come in contact with food.

Type 303, machining; carbon .2 max., sulphur .15 min., chromium 18-20 and nickel 8-10; has high ductility and free-cutting properties; resists heat to 1550 degrees Fahr., and tensile strength to 200,000 lb. per sq. in.; recommended for same purposes as above where free cutting is desirable.

Rustless 18-12 Mo., types 316-317; carbon .09 max., chromium 16-20, nickel 14 max., molybdenum 2-4; corrosion-resistant; used for parts in paper and pulp, and chemical industries.

Columbium type 347; carbon .1 max., chromium 17-20, nickel 8-12; columbium ten times carbon; same properties as Defistain except welded equipment does not require annealing after welding material is stabilized.

- - 3 - - - - 8 - -
DEWARD—Allegheny-Ludlum Steel Corp., Pittsburgh. Carbon .9, manganese 1.5, molybdenum .3; for holders for thread chasers and gang punches. Oil hardening.
See advertisement, Page 99

- - - - - 6 - - - -
DOLE THERMOSTATIC BIMETAL—The Dole Valve Co., Chicago. In strips and fabricated elements; for stamping and coiling; good magnetic properties; good weldability; recommended heat treatments are 600-700 degrees Fahr.; free end of thermal element deflects proportionately with changes in temperature; used to provide protection against excessive temperature and temperature control at predetermined temperatures.

1 - - 4 - - - - - -
DOLER-ALUMIN — Doehler Die Casting Co., New York. Aluminum base die castings. Composition suited to meet stringent requirements, as high tensile strength, impact strength, hardness, corrosion resistance, thermal conductivity and electrical conductivity.

1 2 - 4 - - - - - -
DOLER-BRASS—Doehler Die Casting Co., New York. Brass die castings. Composition suited to meet varying conditions. Tensile strength to 100,000 lb. per sq. in., and hardness to 180 brinell; excellent corrosion resisting properties.

- - - 4 5 - - - - -
DOLER-MAG—Doehler Die Casting Co., New York. Magnesium base die castings made from the lightest of the commercial metals; one-third lighter than aluminum.

- - - 4 - - - - - -
DOLER-ZINK—Doehler Die Casting Co., New York. Zinc base die castings of maximum tensile and impact strength.

- - - 4 - - - - 9 10
DOWMETAL—The Dow Chemical Co., Midland, Mich. Magnesium alloy ingots, castings, wrought forms, rods, bars, sheet, shapes, extrusions, sand and die castings; also forgings, magnesium metal ingots and magnesium metal sticks. Available in various types:

C; aluminum 9, manganese .1, zinc 2, remainder magnesium; in ingots for sand casting; ult. tensile strength, 39,000 lb. per sq. in.; compressive, 60,000; yield strength, 14,000; elongation, 10 per cent; impact resistance, high; high elastic resilience; specific gravity 1.82; nonmagnetic; resists corrosion caused by caustic chromic acid, hydrofluoric atmospheres, etc.; used for reciprocating parts and housings.

J-1; aluminum 6.5, manganese .2, zinc 1, remainder magnesium; in rough bars or billets, finished rods or bars, tubing, sheets, coiled strips, plates; for hot forging, extruding, rolling, drawing and pressing; ult. tensile strength, 43,000 lb. per sq. in.; compressive, 69,000; yield strength, 30,000; elongation, 17 per cent; endurance limit (completely reversed bending), 17,000 lb. per sq. in.; specific gravity, 1.8; nonmagnetic; high elastic resilience; for structural parts and fabricated housings.

M; manganese 1.5, remainder magnesium; in the same form as J-1 for sand casting, hot forging, rolling, drawing and pressing. Mechanical properties in rolled state: Ult. tensile strength, 37,000 lb. per sq. in.; yield strength, 27,000; elongation 9 per cent; impact resistance, high; specific gravity, 1.76; nonmagnetic; weldability, good; heat-resistant to 400 degrees Fahr.; high elastic resiliency; for parts requiring best salt-atmosphere resistance of magnesium alloys.

O; aluminum 8.5, manganese .2, zinc .5, remainder magnesium; in rough bars or billets, finished rods or bars and tubing; for hot forging and extruding. Mechanical properties in heat treated state: Ult. tensile strength, 52,000 lb. per sq. in.; compressive, 75,000; yield strength, 36,000; elongation, 8 per cent; impact resistance, high; endurance limit (completely reversed bending), 18,000 lb. per sq. in.; specific gravity, 1.8; nonmagnetic; high elastic resiliency; for structural parts requiring maximum strength.

R; aluminum 9, manganese .2, zinc .6, remainder magnesium; in ingots for die casting. Mechanical properties in untreated state: Ult. tensile strength, 33,000 lb. per sq. in.; yield strength, 24,000; elongation 3 per cent; impact resistance, high; specific gravity, 1.74; abrasion resistance, medium; nonmagnetic; for housings and structural parts.

- - - 4 5 - - - - -
DUCTILOY—Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Detroit. Carbon .15, manganese .7, chrome .55, silicon .85, nickel .15, copper .2, zirconium .15, phosphorus .025, sulphur .025; in rough bars or billets, finished rods or bars, sheets, strips, plates, for hot forging, stamping, extruding, turning, boring, welding, cold forming, etc.; abrasion resistance, medium; tensile strength, ult., 75-80,000 lb. per sq. in.; ductility, high; specific gravity, 7.85; weldability, good; brinell hardness, untreated 160; fatigue and impact resistant; for frames, bases, small axles and power transmission shafting.

- - 3 - - - - - - -
DUQUESNE SPECIAL—Continental Roll & Steel Foundry Co., East Chicago, Ind. Chrome-nickel-molybdenum steel for rolls subject to severe service; also for abrasive castings.
See advertisement, Page 167

1 2 3 - - - - - - -
DURALOY—Duraloy Co., Scottdale, Pa. High-chrome, iron and chrome-nickel alloys in a number of different grades with minor and major variations in analyses to meet a wide variety of requirements.

1 2 3 - - - - - - -
DURASPUN—Duraloy Co., Scottdale, Pa. Centrifugal castings including tubing with a wide range in wall thicknesses, and odd shapes such as materials conveyor screws.

1 2 - - - - - - - -
DURCO—Duriron Co. Inc., Dayton, O. Alloy steels (KA2S, KA2SMo., etc.); 18 chrome, 8 nickel, carbon max. .07, and other standard as well as special analyses preferred by users; for pumps, valves, fittings, castings for corrosive service, etc.

- - - - - 6 - - - -
DUREX—Moraine Products Div., General Motors Corp., Dayton, O. Products of powder metallurgy in iron, bronze and other metals; self-oiling bearings and various small parts for electric motors, instruments, airplanes, tanks, etc.

1 - 3 - - - - - - -
DURICHLOR—Duriron Co. Inc., Dayton, O. Silicon 14.5, molybdenum 4, carbon .80, traces of phosphorus and sulphur, balance iron; for pumps, valves, pipe, castings for corrosive service, especially for hydrochloric acid and chloride solutions.

1 2 - - - - - - - -
DURIMET—Duriron Co. Inc., Dayton, O. Nickel 22, chromium 19, silicon, molybdenum and copper 5 approx., carbon .07 max., balance iron; for pumps, valves, bolts, nuts and castings for corrosive service, especially weak sulphuric acid.

1 - 3 - - - - - - -
DURIRON—Duriron Co. Inc., Dayton, O., and licensees. Silicon 14.50, carbon .8, manganese .6, sulphur and phosphorus traces, balance iron; for pumps, valves, exhaust fans, mixing nozzles, and castings for handling acids and other corrosive liquids and gases.

1 - - 4 - - - - - -
DURO-GLOSS—Jessop Steel Co., Washington, Pa. Stainless steels in following grades:

C-1, type 410; ult. strength, 70,000 lb. per sq. in.; yield point, 40,000; elongation in 2 inches, 35 per cent; used for automotive, chemical and electrical appliance equipment, gates and valves, etc.

C-2, type 430; ult. strength 80,000 lb. per sq. in., yield point 50,000; elongation in 2 inches, 35 per cent; brinell hardness, 163; used for chemical plant equipment, condensers, steam engine parts, pump shafts, fans, blowers, restaurant equipment, etc.

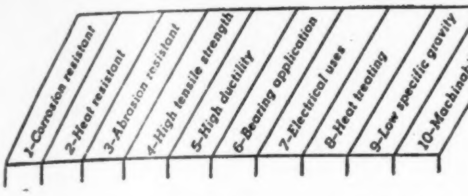
C-3, type 442; ult. strength 80,000 lb. per sq. in.; yield point 55,000; elongation in 2 inches, 35 per cent; brinell hardness, 171; used for same type of applications as C-4, but intended for use at slightly lower temperatures.

C-4, type 446; ult. strength 90,000 lb. per sq. in.; yield point, 55,000; elongation in 2 inches, 25 per cent; brinell hardness, 171; used for tubes, manifolds, linings, etc.

1 - - 4 - - - - - -
DURONZE ALLOYS — Bridgeport Brass Co., Bridgeport, Conn. High copper-silicon bronzes alloyed with elements such as tin, iron, aluminum, etc.; possess high strength combined with corrosion resistance.

I; possesses excellent cold working properties; for making cold-headed bolts and screws, average 100,000 lb. per sq. in. tensile strength; in rod, wire and sheet form.

II; hot-rolled sheet for making range boilers, automatic heaters and storage tanks by either electric arc or oxyacetylene weld-



ing methods; cold-rolled strip used as a substitute for phosphor bronze spring metal; rod and wire used for making hot-headed bolts and screw products; supplied in sheet, rod, wire, and ingot forms.

III; supplied in rod form only; tensile strength from 85,000-100 000 lb. per sq. in.; hot forgings 90,000 lb. per sq. in.; free-machining for making screw machine parts, also for sucker rods for corrosive oil wells; ten per cent lighter than brass; excellent corrosion resistance; in ingot form may be used for making sand castings with tensile strength about 70 000 lb. per sq. in. Used for compression fittings for oil and gas lines in airplane construction, sliding parts for machine guns, small gears, screws, pinions, valve parts, etc.

IV; made into condenser tubes only; for resisting corrosion from aerated sea water mixed with fresh water and acid wastes, sewage, etc., often found in harbors.

V; wire for making difficult cold-headed parts, screws, bolts, rod, sheet and tubing for outdoor service; malleable; good corrosion resistance; tensile strength, about 100.000 lb. per sq. in. recommended for cold-headed bolts and outdoor use.

1 - 3 - - - - 8 - -

DYNAMIC STEEL—Continental Roll & Steel Foundry Co., East Chicago, Ind.

C-2; carbon-manganese-nickel cast steel for parts requiring high physical properties; for tractor frames, locomotive castings, etc.

C-3; carbon-manganese-nickel cast steel for resisting wear after a preferential heat treatment; for sprockets, spindles, wheel centers, cross heads, etc.

C-3-A; carbon-manganese-molybdenum cast steel for parts requiring high physical properties, with machinability; for gears, racks, sprockets and miscellaneous castings.

C-4; nickel-vanadium alloy; heat treated, having high physical properties especially suitable for rolling mill pinions.

C-5; carbon-manganese-nickel-moly steel for rams and saw blocks; high physical properties and high impact value.

C-6; chromium cast steel for special abrasive and crushing work; for sand mills, rock crushers, etc.

C-7; carbon-chromium-nickel-molybdenum cast steel for castings requiring high physical and severe service qualities.

C-8; carbon-manganese-vanadium steel for air-hardening.

C-10; carbon - chrome - molybdenum - vanadium steel for die blocks and crane wheels; superior wear resistance and high physical properties.

See advertisement, Page 167

- - - 4 5 - - - - -

DYN-EL—Alan Wood Steel Co., Conshohocken, Pa. Furnished in sheets, strips, and plates, for stamping, welding, cold and hot forming, etc.; abrasion resistance, medium; tensile strength 70-80 000 lb. per sq. in.; ductility high; weldability good; fatigue and impact values high; for structures requiring high strength.

E

1 - - 4 5 - - - - -

EASY-FLO—Handy & Harman, New York. Brazing alloy; flows at 1175 degrees Fahr.; silver 50, copper 15.5, zinc 16.5, cadmium 18; resists corrosion due to silver content; specific gravity 9.49; for brazing ferrous and nonferrous metals, particularly dissimilar metals and monel metal, stainless steel and other copper-nickel and chrome-nickel alloys. Has many electrical uses.

1 - - - 5 - - - - -

ECLIPSE Seamless Flexible Metal Hose—Eclipse Aviation Div., Bendix Aviation Corp., Philadelphia. Bronze 85/15, with 3 per cent silicon, steel, aluminum, silver and various other alloys. Tubing resists corrosion caused by salt water, ammonia, steam, gases, etc., and heat up to various degrees Fahr. Has high ductility and can be used where flexible tubing is required.

- - - 4 5 - - 8 - -

ECONOMO—Wheelock Lovejoy & Co., Inc., Cambridge, Mass. Carbon .2 and .5 with alloy of molybdenum; free machining; for machine tool parts.

1 2 - - - - - - - -

EIS 57—Heppenstall Co., Pittsburgh. Nickel-chrome-molybdenum-steel, .6 carbon; for insert and hot die steel service.

- 2 3 - - - - - - -

EIS 45—Heppenstall Co., Pittsburgh. Carbon .85 chrome 12. Furnished for hot forging into parts. Used for shear blades for shearing medium heavy material.

- - - 4 5 - - 8 - 10

ELASTUF—Horace T. Potts Co., Philadelphia. (Note: "Elastuf", together with each of the following types, is a copyrighted term which should be used in specifying these materials. Thus, "Elastuf Type A Heat Treated," etc.)

- - - 4 5 - - - - -

Type A steel, heat-treated; special analysis chrome-vanadium steel; carbon .25-.35 up to 2 in. round, and carbon .45-.55 over 2 in. round; furnished in rough bars or billets and forgings, for turning, boring, etc. Has excellent tensile strength at elevated temperatures. Used where maximum strength, resistance to impact, fatigue, wear, shear or compression is required.

- - - 4 5 - - 8 - -

Type A alloy steel, annealed; special analysis chrome-vanadium steel; carbon .45-.55; furnished in rough bars or billets and forgings. Brinell hardness, untreated 200, heat-treated 600. For parts which must be hardened and where maximum toughness is required such as cams, plastic molds, mandrels, clutch parts, etc.

- - - - - - - - - 10

Type C. H. free-machining case-hardening steel, hot-rolled; furnished in rough bars or billets, and finished rods or bars, for turning, boring, etc.; tensile strength 70,000 lb. per sq. in.; high ductility; used for mass production parts needing machinability and excellent case hardening properties.

Licensees are: Brown-Wales, Boston; Beals, McCarthy & Rogers Inc., Buffalo; Equitable Equipment Co., New Orleans.

- - 3 4 - - - - - -

ELASTUF "44"—Horace T. Potts Co., Philadelphia. Chrome-nickel-molybdenum alloy steel furnished in rough bars or billets. Has high abrasion resistance; tensile strength, ult., 220.000 lb. per sq. in.; medium ductility; and brinell hardness, heat-treated, approximately 420. Used for gears, pinion shafts, and for parts requiring high strength and high hardness.

- - - 4 5 - - - - -

ELASTUF CHRO-MOLY—Horace T. Potts Co., Philadelphia. Chrome-molybdenum alloy steel, hot-rolled, heat-treated; carbon .35-.45 up to 4 in. round, and .45-.55 carbon over 4 in. round; furnished in rough bars or billets and forgings, for turning, boring, etc. Used for heavy-duty parts requiring high tensile properties with exceptional impact strength.

- - - 4 5 - - 8 - 10

ELASTUF CHRO MOLY (Modified)—Horace T. Potts Co., Philadelphia.

- - - 4 5 - - - - 10

NE 8744—Heat-Treated; special chrome-nickel-molybdenum alloy steel of National Emergency type; heat-treated to high physical properties for uses requiring high tensile, fatigue and impact strength. Furnished in machinable condition.

- - - - - - - 8 - 10

NE 8744—Hot-Rolled Annealed; furnished in readily machinable condition for parts requiring greater than machinable strength.

- - - 4 - - - - - 10

ELASTUF PENN—Horace T. Potts Co., Philadelphia. Hot-rolled steel furnished in rough bars or billets, and finished rods or bars for hot forging, turning, boring, etc.; tensile strength 125,000 lb. per sq. in.; medium ductility. Used where maximum strength in a carbon machinery steel is required or where untreated alloys of simpler type have been used.

ELECTROMET — Electro Metallurgical Sales Corp., New York. A line of ferro-alloys and alloying elements of various analyses.

See advertisement, Page 107

1 - - - - - - - - -

ELECTRUNITE—Steel and Tubes Division, Republic Steel Corp., Cleveland. Electric-welded tubing in stainless, carbon, and chrome-moly steel. Square, rectangular, oval, or other shapes, in any size or gage where the periphery of the shape is not less than 2-1/32 inches or more than 16 inches. Used for general mechanical, aircraft, conduit, boiler, condenser, heat exchanger and other pressure applications.

1 - - - - - - - - -

ELEPHANT BRAND Phosphor Bronze—The Phosphor Bronze Smelting Co., Philadelphia. Furnished in wire and sheets; sheets in rolls, slit sheet metal, tinned both sides; in various gages and tempers covering a broad range of uses. Wire in coils for springs, flat wire, in coils or lengths; tinned binding for armature work, binding wire (round), dead soft to any temper required; straightened (round), in lengths.

See advertisement, Page 195

- 2 - 4 - - 7 - - -

ELKALOY—P. R. Mallory & Co. Inc., Indianapolis. A work-hardened alloy of copper, not heat-treatable, for spot and seam welding aluminum and its alloys, unpickled hot-rolled steel, terne plate, tin plate, galvanized iron and other materials. A direct substitute for copper, it handles the same but is harder and lasts longer.

- 2 3 - - - 7 - - -

ELKONITE—P. R. Mallory & Co. Inc., Indianapolis. Two definite classes of materials. One group based on copper and such refractory metals as tungsten, molybdenum and their carbides—combinations which produce material with good electrical conductivity and great wear-resistant qualities, for use as welding electrodes and contactors in oil-immersed circuit breakers. Another group is based on silver and refractory materials such as tungsten, molybdenum and their carbides, and has been developed primarily as a facing material for heavy duty electrical contacts and contactors for air breakers. This material can be used either in the form of a thin facing or as an insert with copper or copper alloy backing material.

- - 3 - - - - - - -

ELVERITE—Babcock & Wilcox Co., New York. Special chilled iron castings: for tube mill lining, car wheels, jaw crushers, sprockets, etc.

1 2 - - - - - - - -

ENDURO — Alloy Steel Div., Republic Steel Corp., Massillon, O. Stainless and heat-resisting alloy.

Chromium-nickel group:

17-7; chromium 17, nickel 7, carbon .09-.2; used for automotive trim and for deep drawing where straight chromium types are not sufficiently ductile.

18-8; chromium 18, nickel 8, carbon cont. .08-.2; especially suited to resist atmospheric corrosion and corrosion reagents; for dairy and chemical plant equipment, food and meat processing machinery, high-strength, lightweight structural members, and for resistance to oxidation at elevated temperatures.

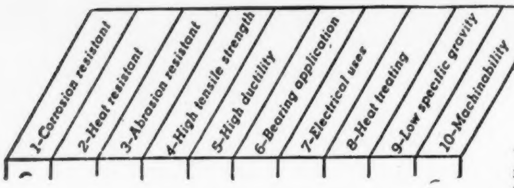
18-8-S; similar to 18-8 except carbon is kept under .08 which permits its use in welded equipment subject to severe corrosion.

18-8-FS; a special modification of 18-8 to develop greater softness and less work hardening; better adapted to successive drawing and spinning operations with less annealing than 18-8.

18-8-STi; 18-8-S to which titanium has been added for eliminating intergranular corrosion at high temperatures; used for airplane collector rings and exhaust manifolds, and other high temperature requirements.

18-8-SCb; 18-8-S plus columbium; for applications similar to those for which 18-8-STi is recommended. More efficient as carbide stabilizer and better corrosion resistance than titanium.

18-8-SMo: 18-8-S plus 2 to 3 molybdenum; resistant to acids encountered in paper and pulp processes, woolen dyeing and in chemical and pharmaceutical industries; recom-



mended for severe corrosive conditions; good fabricating and welding properties.

18-8-B; 18-8 with 2 to 3 silicon; for resistance to oxidation in temperatures up to 1700 degrees Fahr.; for annealing boxes, furnace parts, etc.

18-8-FM; a free-machining type of 18-8 through addition of .07 min. selenium; machinability very good for chromium-nickel type—about 70 per cent that of screw stock. Corrosion resistance same or little less than 18-8.

19-9-SMo; a modification of 18-8-SMo with higher alloy content for applications requiring somewhat higher corrosion resistance than 18-8-SMo.

HCN; chromium 25, nickel 12; for resistance to oxidation up to 2000 degrees Fahr.; fabricates, machines, and welds readily. High strength and creep at elevated temperatures. Not recommended for high sulphur conditions at high temperatures.

HCN-Low Carbon; a variation of HCN with carbon .08 max. for applications involving welding and corrosion resistance to eliminate carbide precipitation.

NC-3; chromium 25, nickel 20, silicon 2 max.; for maximum heat resistance. Best strength and creep at high temperatures, but may be attacked if sulphur present in gases. Resistant to carburizing.

S-Turbine Quality; chromium 11.5-13, carbon .15 max. used for applications where corrosion resistance and physical strength are needed at medium high temperatures.

S-High Carbon; a straight chromium, high-carbon grade for heat treating for high hardness applications.

Straight chromium group:

S-1; chromium 10-14, carbon .15 max., responds readily to heat treatment and is recommended where strength, toughness and hardness are required; for pump shafts, valve seats and stems, nuts and bolts, etc.

S-1 Nickel; a modification of S-1 with addition of 2 max. nickel for somewhat better physical properties than S-1.

FC; free machining grade of S-1 analysis. Machines nearly as well as screw stock. Fairly resistant to the atmosphere, organic and fruit acids, etc. Can be hardened by heat treatment up to about 400 brinell. Considerably more care and control required in forging operation than with S-1.

FC High Carbon; a high carbon variation of FC having better physical properties than FC.

AA; chromium 14-18, carbon .12 max.; good corrosion resistance; heat resistant to 1500 degrees Fahr.; fabricating and welding properties inferior to 18-8; for bicycle fenders, oil burner parts, etc.

AA High Carbon, a variation of AA with somewhat better physicals.

AA-FM; a free-machining codification of AA with machinability about 85-90 per cent of Bessemer screw stock.

HC; chromium 23-30; heat-resistant to 2000 degrees Fahr.; not affected by sulphur gases; strength and creep at high temperatures not as good as the chromium-nickels.

18-23; chromium 18-23; high heat resisting properties; good resistance to scaling, but strength and creep lower than chromium-nickel types; for furnace parts, etc.

4-6 per cent; chromium 4-6 with several carbon ranges to .25 and with or without addition of molybdenum or columbium, titanium, aluminum and tungsten; additions of columbium, titanium or aluminum practically eliminate air-hardening on welding; corrosion and heat resistance considerably superior to that of carbon steels, and with fair strength at high temperatures; for oil refinery and furnace parts.

- - - 4 5 - - - - 10

ERMAL—(Z-Metal)—Erie Malleable Iron Co., Erie, Pa. A spheroidized pearlitic-malleable cast iron: for castings requiring rigidity, high tensile strength, and abrasion resistance. Suitable for heat treatment.

- - 3 4 - - - - - -

ERMALITE—Erie Malleable Iron Co., Erie, Pa. Wear-resisting alloy iron; for gears, wearing plates, friction drums and other parts subject to high stresses or wear.

- - - 4 - 6 - - - -

EVANSTEEL—Chicago Steel Foundry Co., Chicago. Nickel 1-1.5, chromium .65-1, carbon varies from .3-.5, sometimes carries additions of vanadium or molybdenum; for castings such as passenger car knuckles, tooth bases, sprockets, gears, high pressure valves, etc.

1 - - 4 5 - - - - -

EVERDUR — American Brass Co., Waterbury, Conn.

Alloy No. 1010; copper 95.8, silicon 3.1, manganese 1.1; uses include tanks and sewage disposal apparatus.

Alloy No. 1015; copper 98.25, silicon 1.5, manganese .25; easily fabricated by all methods including welding; used for tubes, bolts and screws.

Alloy No. 1000; casting alloy; copper 94.9, manganese 1.1, silicon 4.

See advertisements, Pages 92-93

F

1 2 3 - - - - - - -

FACEWELD—Lincoln Electric Co., Cleveland. Coated-type electrodes for hard-facing worn parts of straight carbon, medium carbon or manganese steel to resist severe abrasion and moderate impact.

No. 1 (yellow tip); deposits of single layer have hardness of 45-52 Rockwell C. Multiple layers have hardness of 52-58 Rockwell C. Toughness of this deposit is greater than that of No. 12.

No. 12 (red tip); single layer hardness is 52-57 Rockwell C. Multiple layer hardness is 55-59 Rockwell C.

1 2 - 4 - - - - - -

FAHRITE—The Ohio Steel Foundry Co., Springfield, Ohio.

1 2 - - - - - - - -

N-1; carbon .4-.6, chromium 15-18, nickel 34-38; in rods, bars and sand castings; resists oxidation to 2000 degrees Fahr.; has high strength and ability to withstand thermal shock at high temperatures; good weldability; ult. tensile strength, 70,000 lb. per sq. in.; specific gravity, 7.94; brinell hardness as cast 165-185; for trays, chain links, retorts and furnace parts.

1 2 - 4 - - - - - -

N-3; carbon .3-.5; nickel 10-13; chromium 24-27; in rods, bars, sand castings and centrifugal tubes; resists oxidation to 2000 degrees Fahr. and corrosive attack in sulphur atmosphere; has high strength at elevated temperatures; good weldability; ult. tensile strength, 90,000 lb. per sq. in. with 20 per cent elongation; specific gravity, 7.73; brinell hardness as cast 165-175; for tube supports, baffles, dampers, boxes, trays and retorts.

1 2 - - - - - - - -

N-61; carbon .4-.75, nickel 59-62, chromium 10-15; in sand castings; resists oxidation to 2000 degrees Fahr.; good weldability; ult. tensile strength, 70,000 lb. per sq. in.; specific gravity, 8.13; brinell hardness as cast 175-185; for carburizing furnace parts.

C-28; carbon .35 max., nickel 3 max., chromium 25-30; in sand castings; resists oxidation to 2100 degrees Fahr.; but has low high temperature strength; highly resistant to sulphur gas atmosphere; poor weldability; ult. tensile strength, 90,000 lb. per sq. in. with 18 per cent elongation; specific gravity, 7.6; brinell hardness, 150-200; for use where resistance to high temperature in sulphur gas atmosphere is required.

- 2 - 4 - - 7 - - -

FANSTEEL MOLYBDENUM—Fansteel Metallurgical Corp., North Chicago, Ill. Molybdenum 99.9+; in finished rods or bars, wire, sheets, strips and powder metal; for stamping, turning, boring, welding into parts; ult. tensile strength, 260,000 lb. per sq. in.; impact resistance, high; hardness, 147 brinell; specific gravity, 10.2; nonmagnetic; resists corrosion caused by most acids; heat resistant to 3000 degrees Fahr.; abrasion resistance, medium; used for critical electrical parts.

1 - - - 5 - - - - 10

FANSTEEL TANTALUM—Fansteel Metallurgical Corp., North Chicago, Ill. Tantalum 99.9+; in finished rods or bars, tubing, wire, sheets and strips; for stamping, turning, boring, welding, etc.; ult. tensile strength, 42-178,000 lb. per sq. in.; impact resistance, medium; hardness, 75-125 brinell; specific gravity, 16.6; nonmagnetic; weldability, good; for corrosion-resisting parts.

- - 3 4 5 - - - - -

FARRELL'S 85—Farrell-Cheek Steel Co., Sandusky, O. Specially processed steel castings for resisting abrasion, and possessing high strength, toughness and rigidity; tensile strength up to 150,000 lb. per sq. in.; used for parts subject to shock, high stress, overload, wear and abrasion.

- - 3 4 5 - - - - -

FARRELL'S HARD EDGE—Farrell-Cheek Steel Co., Sandusky, O. Furnished as sand castings; high abrasion resistance; high tensile strength and ductility; brinell hardness, heat-treated 650-700 and higher; for crane wheels, cast tooth gears, rollers, sheaves, sprockets, traction wheels.

- - - - - 6 - - - -

FEDERAL BRONZES — Federal-Mogul Corp., Detroit.

F1; a gear bronze suitable for heavily loaded piston pin bushings, etc.

F2; lead bronze for average bushing application.

F3; used largely as backs for babbitt-lined bearings.

F5; widely used for babbitt-lined bearing backs and for bushings where service is not severe.

F8; good casting and machining qualities.

F11; for piston pin bushings and other low speed, heavily loaded applications.

F15; has 20 per cent lead and may be used safely under adverse lubrication conditions.

F-16; because of high lead content may be used where only occasional lubrication is possible.

F18; high lead alloy of good casting characteristics.

F20; a hard bronze used for gears and worm wheels where requirements are severe; also aluminum-bronze and special analysis bronzes.

- - - 4 - - - - - -

FERROWELD—Lincoln Electric Co., Cleveland. For arc welding cast iron. Has steel base to give solid weld on cast iron of greater tensile strength than the cast iron itself. Due to low current which can be used, hardening effect usually present along the line of fusion is materially reduced.

- - 3 - - - - - - -

FIRTHALOY—Firth-Sterling Steel Co., McKeesport, Pa. Highly developed form of sintered carbide adapted to wire drawing dies, extrusion dies and similar purposes.

- - 3 - - - - - - -

FIRTHITE — Firth-Sterling Steel Co., McKeesport, Pa. Hard metal composition of sintered carbides furnished in number of grades to form wearing surfaces or the edges of cutting tools.

- - 3 4 5 - - - - -

FIVEPOINT DEEPHARD STEEL—Foote Bros. Gear & Machine Corp., Chicago. Low-carbon steel parts, regardless of SAE type, manufactured by the company and hardened by its Five Point Deephard process which can be applied also to castings, forgings, bar or plate steel, and results in superior wearing qualities. Company also has special alloy steel of a nickel-moly-chrome analysis, used especially to improve cores where it is otherwise impossible to obtain core hardness over 300 brinell because of excessive bulk.

- - 3 4 5 - - - - -

FLAMALOY—Detroit Alloy Steel Co., Detroit. Furnished as castings. Carbon .35-.45, manganese 1-1.25, chromium 1-1.1, copper .9-1, molybdenum .3-.45; medium abrasion resistance; tensile strength, ult., 130,000 lb. per sq. in.; high ductility; recommended heat treatments approx. 1500 degrees Fahr. water quenched; brinell hardness, untreated 200, heat-treated 630; for miscellaneous machine parts.

1—Corrosion resistant
2—Heat resistant
3—Abrasion resistant
4—High tensile strength
5—High ductility
6—Bearing application
7—Electrical uses
8—Heat treating
9—Low specific gravity
10—Machinability

\- - - 4 5 - - - - -
FLEETWELD—Lincoln Electric Co., Cleveland. Shielded arc electrode for welding mild steel.

Type 5; for flat, vertical and overhead welding. Tensile strength, 65-75,000 lb. per sq. in.; ductility, 20 to 30 elong. in 2 in.; impact resistance, 30-70 ft. lbs. (Izod); density 7.84-7.86 grams per c.c.; corrosion resistance greater than mild steel.

Type 7; for general purpose welding and where fit-up is not of the best; low spatter and slag loss, high burn-off rate. Physical properties as welded; tensile strength, 70-80,000 lb. per sq. in.; yield point 55-66,000 lb. per sq. in.; ductility, approximately 17 per cent elong. in 2 in.; specific gravity, 7.80.

Type 8; heavily coated electrode of shielded arc type for fillet welding in down positions only. Capable of producing fillets, (one plate vertical), up to 3.8 in size in one pass. Tensile strength, 65-75,000 lb. per sq. in.; yield point 47-63,000 lb. per sq. in.; elong. 20 to 30 per cent in 2 in. Can be used with either alternating or direct current.

Type 9; heavily coated electrode of shielded arc type specifically for flat welding of deep groove joints. Physical properties as welded; tensile strength, 66-74,000 lb. per sq. in.; yield point, 55-60,000 lb. per sq. in.; elong. 20-30 per cent in 2 in.; specific gravity, 7.85-7.86; operates either with d.c. or a.c.

Type 9-HT; heavily coated electrode of shielded arc type for deep-groove welding in a flat position of high tensile steels.

Type 10; for downhand welding on flat surfaces for finish bead welding and to provide full slag coverage and smoothness. Can be used with either direct or alternating current normal or reverse polarity.

Type 11; heavily coated electrode of shielded arc type for downhand fillet welding with "Fleet-Fillet" technique. Physical properties similar to Type 9.

1 2 3 4 - - 7 8 - -
FRANKITE—Frank Foundries Corp., Moline, Ill.

\- - - 4 - - - - - -
E-212; low-carbon electric furnace iron; pressure-resistant and long-wearing dense grain in heavy sections; for hydraulic bodies, refrigerator parts, compressor cylinders, etc. Good machinability.

1 2 - - - - 7 - - -
E-450; nickel 14, chromium 2, copper 6, electric furnace Ni-Resist. Has corrosion resistance, heat resistance to 1500 degrees Fahr.; fair machinability.

\- - 3 - - - - - - -
E-604; nickel 4½, chromium 1½, electric furnace Ni-Hard white iron. Combats corrosion; for mixer blades, ash chutes, scrapers, grinding burs, etc.; machinability by grinding.

1 2 - 4 - - - - - -
E-830-N; chromium 30, nickel 3, low carbon; heat-resistant; for continuous oven kilns, cement kiln cooler parts, furnace supports, etc.; machinability, fair.

1 - 3 - - 6 - - - 10
FRONTIER—Frontier Bronze Corp., Niagara Falls, N. Y. Available in following grades:

1 - 3 - - - - - - 10
40 E; in sand castings and ingot form; not heat-treated; tensile strength, 30-38,000 lb. per sq. in.; yield strength, 22-26,000 lb. per sq. in.; elongation, 3-10 per cent; resists salt water corrosion; abrasion resistance, high; excellent machinability; resistant to hydrostatic pressure; resistance to shock and impact, high.

No. 5 aluminum bronze; in castings; tensile strength, 60-95,000 lb. per sq. in.; compressive strength, 22-65.000 lb. per sq. in.; ductility, good; brinell hardness, untreated, 130; heat-treated, 130-200; for parts where resistance to shock, fatigue and wear are essential.

\- - - - - 6 - - - -
No. 11 nickel bronze; good bearing qualities with positive lubrication; wear-resistant; heat-treated, tensile strength, 60-70.000 lb. per sq. in.; yield strength, 38-45,000 lb. per sq. in.; elongation, 15-20 per cent; brinell, 160.

G

\- - - - - 6 - - - -
G ALLOY—American Smelting & Refining Co., New York. Lead-bearing alloy furnished in ingots for spinning and mold casting. Resists heat up to 300 degrees Fahr.; abrasion resistance, high; tensile strength, ult., 10,000 lb. per sq. in.; compressive strength, ult., 15,000 lb. per sq. in.; good bearing properties; brinell hardness, untreated, 22. Used for bearing applications.

\- - - - 5 - 7 - - 10
GIBSILOY—Gibson Electric Co., Pittsburgh. Electrical contacts having high ductility, good weldability and machinability:

A1; silver 95, nickel 5; in wire, sheets and powder metal; for stamping or individually molding; specific gravity, 10.40. Available in grades from A1 to A8, the latter containing silver 60 and nickel 40, for stamping or molding, with a specific gravity of 9.79.

C, C1 to C7; containing silver and graphite, from 99-1 to 93-7; in sheets and powder metal compacts for stamping and individual molding; specific gravity from 10.13-8.36.

NW; silver-nickel-tungsten alloy, any combination; furnished as powder metal compacts to be fabricated into parts by individual molding methods; high hardness; medium electrical resistance; for electrical contacts.

1 - - - - - - - - -
GLOBE STAINLESS STEEL—Globe Steel Tubes Co., Milwaukee. Seamless steel tubing in common steels as well as most grades of SAE alloys, and stainless or corrosion-resisting steel.

See advertisement, Page 175

\- - - - - 6 - - - -
GLYCO BABBITT—Joseph T. Ryerson & Son, Inc., Chicago. General tradename covering a group of specially processed lead base alloys including:

Turbo-Glyco; for high-speed, heavy-duty; average brinell hardness, 30.

Marine Glyco; for electric motor and marine work; average brinell hardness 27.

Standard Glyco; free flowing, general purpose; average brinell hardness 24.

Heavy pressure mill Glyco; high resistance to crushing loads; average brinell hardness 23.

Transmission Glyco; for line shafting and transmission work; average brinell hardness, 22.

\- - - - - 6 7 - - -
GRAMIX—The United States Graphite Co., Saginaw, Mich. Bearing bronze; resists heat to 300 deg. Fahr.; tensile strength, 12.000 lb. per sq. in.; compressive strength 100,000; specific gravity, 5.9-6.1 (apparent density); brinell hardness, untreated, 500 kilograms —28; used for bearings, contacts, slides and thrust bearings.

See advertisement, Page 90

\- - 3 - - - - - - -
GRAPH-AL—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon 1.5, silicon .15-.25, manganese .4 max., phosphorus and sulphur .025, max., aluminum .12-.20; in hot-rolled bars or billets, finished rods and bars, wire sheets, strips, and plates, for cold-working metal, and for parts subjected to impact. Has good abrasion resistance, tensile strength, annealed, 105,000 lb. per sq. in., min.; medium ductility, good machining properties and response to heat treatment. Brinell hardness, annealed, 197 max., heat-treated, brine quenched 780. Recommended heat treatment, heat to 1450-1550 degrees Fahr., depending on section, and quench in brine.

1 - - - - 6 - - - 10
GRAPHALLOY—Graphite Metallizing Corp., Yonkers, N. Y. Graphite 55, lead base babbit 45; in rough bars or billets, tubing (rough finish), and finished bushings. Available in several grades which differ in hardness, as follows:

A (soft grade); pure electro graphite base, easily machined, suitable only for light-duty service.

S and N; medium hardness, made of carbon-graphite base material.

O (hard grade); suitable for larger bearings in heavy-duty service.

\- - - - - 6 - - - -
GRAPHEX—Neveroil Bearing Co., Wakefield, Mass. A group of more than 30 alloys such as copper base, leaded bronze, whitemetals, special babbitts, etc., in self-lubricated bearings. Depending on alloy, compressive strength is from 30-70,000 lb. per sq. in.; tensile strength, 4000-12,000 lb. per sq. in.; used in bearings.

\- - 3 - - - - - - -
GRAPH-M.N.S.—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon 1.5; manganese, 1.25; phosphorus .025, max., sulphur .025, max., silicon 1, nickel 1.75, molybdenum .5, chromium .5; in hot-rolled bars and billets, finished rods and bars, wire, sheets, strip and plates. Has good resistance to abrasion, and nonscuffing properties when cold forming metal; tensile strength, annealed, ult. 135,000 lb. per sq. in., medium ductility, recommended heat treatment, heat to 1550-1650 degrees Fahr. depending on section; air cool. Brinell hardness, annealed 241, heat-treated 682. Used for various types of machine parts.

\- - - 4 - - - - - -
GUNITE—Gunite Foundries Corp., Rockford, Ill. Processed high-test cast iron in ten grades, with Gunite A as standard metal described here. Mechanical properties in untreated state: ult. tensile strength, 50,000 lb. per sq. in.; compressive, 120,000; impact resistance, medium; hardness, 207-241 brinell; specific gravity, .265 lb. per sq. in.; heat resistant to 1100 degrees Fahr.; abrasion resistance, medium; used for brake drums, hydraulic parts, crank shafts etc.

1 - - - - 6 - 8 - -
GRAPH-MO—Timken Steel & Tube Div. The Timken Roller Bearing Co., Canton, O. Carbon 1.5, silicon .8, manganese .4 max., phosphorus and sulphur .025, manganese .025, molybdenum .25; in hot-rolled bars or billets, finished rods or bars, seamless tubing, wire, strips, sheets and plates, for hot forging, stamping and welding into parts. Has high abrasion resistance; tensile strength, ult., 85,000 lb. per sq. in., min.; medium ductility; fair bearing properties; good weldability; good nonscuffing properties; recommended heat treatments for annealing, normal 1600 degrees Fahr.; 1450 furnace coal, oil quenched, 1475-1550 degrees Fahr.; brinell hardness, annealed 197, heat-treated 745. Used for various machine parts.

\- - 3 - - 6 - 8 - -
GRAPH-SIL—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon 1.5, silicon .9-1, manganese .4 max., phosphorus and sulphur .025 max.; in hot-rolled bars or billets, finished rods or bars, seamless tubing wire, sheets, strips and plates. Tensile strength ult., 97 000 lb. per sq. in., min.; abrasion resistance, high; medium ductility; excellent machining and nonscuffing properties; good weldability; for use as cylinder liners and machine parts. A water or brine quenching steel.

\- - 3 - - 6 - 8 - -
GRAPH-TUNG—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon 1.5, manganese, .4 max., phosphorus and sulphur .025, max., silicon, .65, molybdenum .5, tungsten 3; furnished in hot-rolled bars or billets, finished rods or bars, wire, sheets, strips and plates, for hot forging, stamping and welding. Has high abrasion resistance; tensile strength, ult., 95,000 lb. per sq. in., min.; medium ductility; fair bearing properties; good machining and nonscuffing properties; good weldability; and brinell hardness, annealed 229, heat treated 840; recommended heat treatment, quench in brine from 1450-1500 degrees Fahr. depending on section used for various types of machine parts.

\- - - - - 6 - - - -
GRAPHITAR—United States Graphite Co., Saginaw, Mich. Molded carbon graphite; resists corrosion caused by most chemicals; resists temperatures up to 5000 degrees Fahr. in a reducing or neutral atmosphere; tensile strength, 5000 lb. per sq. in.; compressive strength, 20.000 lb. per sq. in.; used for special bearing and seal applications.

See advertisement, Page 90

H

HANDY FLUX—Handy & Harman, New York. For brazing steel, stainless steel, monel metal, nickel, copper, beryllium-copper, brass, bronze, aluminum-bronze and vari-

1—Corrosion resistant | 2—Heat resistant | 3—Abrasion resistant | 4—High tensile strength | 5—High ductility | 6—Bearing application | 7—Electrical uses | 8—Heat treating | 9—Low specific gravity | 10—Machinability

ous other ferrous and nonferrous metals and alloys. Liquid and active at 1100 degrees Fahr.

\- 2 3 4 - - - - - -
HARDTEM—Heppenstall Co., Pittsburgh. Carbon .5, chrome-molybdenum-vanadium die steel; for die blocks, shafting, etc.

\- - 3 4 5 - - - - -
HARDWELL—Lincoln Electric Co., Cleveland. High-carbon arc welding electrode having brinell of 225-488; provides dense, tough surface of moderate hardness to enable various steel parts to resist shock and abrasion; for locomotive or crane tire flanges, etc.

Type 50; medium-carbon steel electrode for building up steel parts and surfaces. Deposit has considerable resistance to deformation and wear, and is machinable at slow speed. Coating stabilizes the arc and permits deposition of a tough, dense medium carbon steel. Hardness, deposited on straight-carbon steel and allowed to cool naturally, 20 to 35 Rockwell C.

1 2 3 - - - - - - -
HARDY POWDERS—Charles Hardy Inc., New York. Powder metal compressed into parts; give most physical characteristics which are available from metal ore alloys produced by melting and casting. According to metal powders chosen, low or high Brinell hardness can be secured; used for manifolds. Depending also on powders chosen, all properties listed can be obtained.

\- - 3 - - - - - - -
HASCROME—Haynes Stellite Co., Kokomo, Ind. Chromium-manganese-iron composition welding rod for hard-facing parts subject to abrasion and impact, and castings to resist abrasion and impact.

1 2 - 4 - - - - - -
HASTELLOY—Haynes Stellite Co., Kokomo, Ind. Corrosion-resistant, nickel-base alloys for piping, tanks, pump parts, valves, vessels.

A and B; nickel, molybdenum and iron; for resistance to hydrochloric acid.

C; nickel, molybdenum, chromium and iron; for resistance to wet chlorine, and oxidizing or reducing acid solutions.

D; nickel and silicon; for resistance to sulphuric acid, hot or cold.

\- - 3 - - - - - - -
HAYNES STELLITE 93—Haynes Stellite Co., Kokomo, Ind. Ferrous alloy welding-rod for hard-facing metal wearing parts; abrasion resistance, high; tensile strength, ult., 43,040 lb. per sq. in. average; Rockwell hardness, untreated C-62, heat treated, average C-67.

1 2 3 - - - - - - -
HAYNES STELLITE—Haynes Stellite Co., Kokomo, Ind. Nonferrous cobalt-chromium-tungsten alloys for corrosion and wear-resistant castings, hard-facing welding-rod for parts subject to abrasion or a combination of abrasion, heat and corrosion.

\- - 3 - - - - - - -
HAYSTELLITE—Haynes Stellite Co., Kokomo, Ind. Cast tungsten carbide: inserts, tube rod, and composite rod (welding) for hard-facing oil-well drilling tools, dredge cutter blades, etc.

\- 2 3 4 5 - - - - -
HEPPENSTALL 5 H 50—Heppenstall Co., Pittsburgh. Carbon .5, chrome molybdenum and vanadium alloy furnished as die blocks. Material is heat resistant, abrasion resistant, has high tensile strength and high ductility. Used also for strip mill rolls, etc.

\- - - 4 5 - - - - -
HEPPENSTALL 2 C 30—Heppenstall Co., Pittsburgh. Nickel-chrome-molybdenum steel, carbon .3; for shafting where high torsional strength is required such as drop hammer piston rods.

1 - - 4 5 - - - - -
HERCULOY—Revere Copper and Brass Inc., New York.

419 and 421 (types B); silicon 1.5 2.25, either .25 tin or .35 manganese, balance copper; in rods or bars, tubing, wire, sheets, strips (coiled) and plates, for hot forging, stamping, extruding, welding, deep drawing and cold forging; corrosion-resistant; medium abrasion resistant; tensile strength, ult., 45-90,000 lb. per sq. in.; high ductility; for cold-headed bolts, nuts, screws, nails and electrical hardware.

418 and 420 (types A); silicon 3, either .5 tin or 1 manganese, balance copper; same as above; tensile strength, ult., 55-120,000 lb. per sq. in.; high ductility; used for range boilers, and for applications requiring high strength in combination with good weldability and corrosion resistance of copper.

1 - - - - - - - - -
HI-GLOSS—Jessop Steel Co., Washington, Pa. Type 304; stainless steel having ult. strength of 90,000 lb. per sq. in.; yield point, 45,000 lb. per sq. in.; elongation in 2 in., 60 per cent; weight per cu. in. 238 lb.; brinell hardness. 150; used for pumps, airplanes; air conditioning, automotive, chemical, dairy and restaurant equipment, etc.

1 - - - - - 7 - - -
HIPERNIK—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. A magnetic alloy consisting of 49.5 per cent nickel and 49.5 iron; manganese .1; extremely ductile; developed for special magnetic properties at moderately low induction, primarily for radio applications; also used for transformer laminations; melting point is 1450 degrees Cent.; used for relays, radio and current transformers and instrument parts.

\- - 3 - - - - - - -
HUBBARD SPECIAL—Continental Roll & Steel Foundry Co., East Chicago, Ind. Nickel-chrome steel for applications such as wear-resisting rolls, guides and other miscellaneous castings.

See advertisement, Page 167

\- - - - - 6 - - - -
HY-SPEED—Buckeye Brass & Mfg. Co., Cleveland. Copper 88, tin 10, lead 2; for bushings, bearings, bars.

See advertisement, Page 101

\- - 3 4 5 - - 8 - -
HY-TEN—Wheelock-Lovejoy & Co. Inc., Cambridge, Mass. Chrome-manganese-molybdenum and chrome-nickel-molybdenum alloys with carbon from .10-1; machinability, good; for machine parts.

I

\- - - - - 6 - - - -
IDEALOY—Wellman Bronze & Aluminum Co., Cleveland. Copper-tin-zinc alloy for heavy-duty bearings.

1 2 3 4 - - - - - 10
ILLIUM—Burgess Parr Co., Freeport, Ill.

1 2 3 - - - - - - -
G; nickel 54-58, chromium 20-24, copper 5-7, molybdenum 5-7, iron 5-7, manganese .75-1.5, silicon .65, max., carbon .2 max.; brinell hardness 160-210; tensile strength, 60-73,000 lb. per sq. in.; for pumps, meters, chemical equipment and other parts subject to corrosion; resists most corrosive solutions in a wide range of temperatures and concentrations including the halogens in dry state and their salts and acids in low concentrations at ordinary temperatures; resists heat to 1500 degrees Fahr.

1 - 3 4 - - - - - -
R; nickel 54-58, chromium 20-24, copper 0-4, molybdenum 5-7, iron 5-7, manganese .75-1.5, silicon .65 max., carbon .1 max.; brinell hardness 175-240 (annealed) 340-365 (work hardened); tensile strength 95-105.000 lb. per sq. in. (annealed) and 140-150,000 lb. per sq. in. (work hardened); for pumps, meters, chemical equipment and other parts subject to corrosion; resists most corrosive solutions in a wide range of temperatures and concentrations including the halogens in dry state and their salts and acids in low concentrations at ordinary temperatures; resists heat up to 1500 degrees Fahr.

1 2 - - - - - - - 10
INCONEL—The International Nickel Co. Inc., New York. Nickel 79.5, iron 6.5, copper .2, manganese .25, silicon .25, carbon .08, chromium 13, sulphur .015; corrosion resistant, high mechanical properties, resistant to heat to 2000 degrees Fahr.; used for high temperature applications and equipment for handling food and chemical products.

See advertisements, Pages 119, 161

1 2 - 4 - - - - - -
INGACLAD—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago.

Stainless clad steel consisting of a layer of 18-8 chrome-nickel, Type 304, also 18-8 columbium stabilized and 18-8 molybdenum bearing, stainless layer bonded to a layer of ordinary steel; uses include equipment for chemical, food, dairy, processing, brewery, packing house, bottling industries, etc.; suitable for applications requiring stainless steel protection on one surface.

1 2 - - 5 - - - - -
INGERSOLL—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago. Stainless steel in sheets for stamping and welding into parts; resists heat up to 1200 degrees Fahr.; abrasion resistance, medium; tensile strength, ult., 85.000 lb. per sq. in.; ductility, high; brinell hardness, annealed, 165.

J

\- - 3 4 - 6 - - - -
JSB—Johnson Bronze Co., New Castle, Pa. Bronze on steel in finished bearings; medium abrasion resistance; bearing properties, good; used for bushings, bearings, washers, etc. Also babbitt on steel and babbitt on bronze bearings, bronze bearings and bushings, bronze castings.

See advertisement, Page 157

\- - - - 5 - - 8 - -
J & L CORRECT BALANCE (Forging Steel)—Jones & Laughlin Steel Corp., Pittsburgh. Furnished in rough bars or billets, finished rods or bars, and plates, for hot forging. Tensile strength, compressive strength, ductility, weldability, and heat treatments are as specified. Used for any carbon steel parts made from forgings.

\- - - - 5 - - 8 - -
JALCASE—Jones & Laughlin Steel Corp., Pittsburgh.

\- - - - - - - 8 - -
Low-carbon open-hearth steel which offers machinability practically equivalent to Bessemer screw stock plus the added advantage of rapid case carburizing properties; manufactured as S.A.E. X1314 and S.A.E. X1315 in .10 to .20 carbon grades.

\- - - - 5 - - 8 - -
Open-hearth steel which in the higher carbon ranges offers exceptional heat treating qualities combined with forging properties and good machinability; manufactured as S.A.E. X1330 (.25-.35 carbon), S.A.E. X1335 (.30-.40 carbon) and S.A.E. X1340 (.35-.45 carbon).

1 - - 4 - - 7 8 - -
JESSOP—Jessop Steel Co., Washington, Pa.

\- - - 4 - - 7 8 - -
Nonmagnetic steel; in rough bars or billets, finished rods or bars; sheets and plates; medium abrasion resistance; tensile strength, 80-110,000 lb. per sq. in.; medium ductility; specific gravity, 8.02; fair bearing properties; good weldability; brinell hardness, untreated 180, annealed, 150; used for transformer covers, controller covers, switch covers, spacing bars, end fingers, etc.

1 - - 4 - - - - - -
Heat-resisting steels, in No. 4, 5 and 5-B grades; No. 4 has ult. strength 95,000 lb. per sq. in., yield point 50,000 lb. per sq. in.; used for castings, marine submarine and torpedo parts, oil engine valves, pump shafts, etc. No. 5 has ult. strength of 100,000 lb. per sq. in.; yield point 45,400 lb. per sq. in.; used for pump parts, etc. No. 5-B applications are similar to No. 5, but No. 5-B has superior resistance to corrosion, and is more easy to fabricate. No. 5-B is similar in physical properties to No. 5 except that its tensile strength is greater.

1 - - - - 6 - - - -
JOHNSON—Johnson Bronze Co., New Castle, Pa.

No. 27; copper 80, tin 10, lead 10; deoxidized with phosphorus; general purpose bearing bronze.

No. 19; copper 70, tin 11, lead 19; high wear rating and resistance to pounding; for mill

1-Corrosion resistant | 2-Heat resistant | 3-Abrasion resistant | 4-High tensile strength | 5-High ductility | 6-Bearing application | 7-Electrical uses | 8-Heat treating | 9-Low specific gravity | 10-Machinability

bearings, gas and diesel engines, excavating and pulverizing machinery, etc.

No. 25 (plastic bronze); copper 75, tin 5, lead 19, nickel 1; for high speed with light to medium loads and generally free from shock; because it has good acid resistance it is particularly suitable for pump bearings and sleeves, and also for electric motor, conveyor and fan, and woodworking machinery bearings.

No. 29; copper 78, tin 7, lead 15; for use where spindle is of soft steel and speed is relatively high; acid-resisting alloy.

No. 53; copper 88, tin 10, zinc 2; for severe service or heavy pressures; should be used where shaft is hardened steel and well lubricated.

No. 72; copper 83, tin 7, lead 7, zinc 3; best suited for moderate speeds and low loads.

No. 10 (babbitt alloy); tin 90, antimony 5, copper 5; for thin linings and also may be used in die castings.

No. 11; tin 87, antimony 7, copper 6; rather hard babbitt recommended as lining for connecting rods and shaft bearings subjected to heavy pressures.

No. 12; tin 90, antimony 7.5, copper 2.5; for high speeds and high temperatures.

No. LX; lead 74.75, antimony 15, tin 10, copper .25; for camshaft bearings.

See advertisement Page 157

1 2 - 4 - - - - - -

K-42-B—Westinghouse Electric & Mfg. Co., East Pittsburgh. Nickel 46, cobalt 20, iron 12, chromium 18.75, titanium 2.25 furnished in rough bars or billets, rods or bars, wire, strips (coiled), and plates; for hot forging, stamping, turning, boring, welding, etc., also as sand castings; resists corrosion caused by atmosphere and salt solutions; resists heat to 1200 degrees Cent.; tensile strength, ult., 127,100 lb. per sq. in.; nonmagnetic; brinell hardness, heat-treated 280; for applications where high strength at high temperatures is required.

1 2 3 - - - - - - -

KENNAMETAL—McKenna Metals Co., Latrobe, Pa.

Type KM; cobalt 11, tungsten-titanium carbide (W Ti C_2); tungsten carbide WC; columbium carbide constituting balance; for wear parts, etc.; resists heat to 1200 degrees Fahr.; high abrasive resistance; compressive strength about 650,000 lb. per sq. in.; transverse rupture strength 305,000 lb. per sq. in.; hardness, 90.8 Rockwell A (77.6 Rockwell C), thermal conductivity, .113 cal/sec/degrees Cent./cm; volume electrical conductivity, 4.7 per cent of annealed copper standard; thermal expansion about 6×10^{-6}/degrees C; Sp. G. 11.8, Young's modulus about 60,000,000.

Type KH; cobalt 10 per cent, tungsten-titanium carbide (W Ti C_2), and other ingredients, harder than type KM; used for valve balls and brinell balls; compressive strength about 670,000 lb. per sq. in.; transverse rupture strength, 275,000 lb. per sq. in.; hardness, 91.3 Rockwell A, (78.6 C); thermal conductivity .074 cal/sec/degrees Cent./cm.; volume electrical conductivity 3.7 per cent of copper; thermal expansion about 5.5×10^{-6}/degrees Cent.; Sp. G. 11.

Type K3H; similar in composition to other types but harder; compressive strength, 675,000 lb. per sq. in.; transverse rupture strength, 260,000 lb. per sq. in.; hardness, 91.8 Rockwell A, (79.6 C); thermal conductivity, .068 cal/sec/degrees Cent./cm.; volume electrical conductivity, 3.3 per cent of copper; thermal expansion about 5.5×10^{-6}/degrees Cent.; Sp. G. 11.0.

Type K4H; cobalt 7 per cent, tungsten-titanium carbide (W Ti C_2), and other ingredients; the hardest type of Kennametal. Has higher thermal conductivity than others; used for precision boring of steel, machining steel, semi-steel, brass, bronze, aluminum, etc.; compressive strength about 680,000 lb. per sq. in.; transverse rupture strength 225,000 lb. per sq. in.; hardness, 92.3 Rockwell A (80.6 C); thermal conductivity, .12 cal/sec/degrees Cent./cm.; volume electrical conductivity 5.3 per cent of copper; thermal expansion about 5.5×10^{-6}/degrees Cent.; Sp. G. 12.45.

See advertisement, Page 119

- - 3 - - - - - - -

KLEENKUT—Heppenstall Co., Pittsburgh. Tool steel containing 2 carbon and 12 per cent chromium; for shear knives for cold shearing light material.

1 2 - - - - 7 - - -

KONAL—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Nickel 72, cobalt 17, titanium 2.2, iron 6.25; internal combustion engine valves, molds and machine parts which are subject to stress at high temperatures.

1 2 - - - - 7 - - -

KOVAR—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Low expansion to 400 degrees Cent.; approximately 28 nickel, 17 cobalt, balance iron; for gastight metal-to-glass seals on radio tubes instrument parts, electronic tubes and all other glass-to-metal seals. Distributed by Stupakoff Laboratories, Pittsburgh.

1 - 3 - - 6 - - - -

KROKOLOY—Detroit Alloy Steel Co., Detroit. Furnished in castings, chromium 12-14, carbon 1.5-1.6, cobalt 3-3.5, molybdenum .85-.9. Semiresistant to corrosion; heat to 1000 degrees Fahr.; abrasion resistance, high; tensile strength, ult., 125,000 lb. per sq. in.; compressive strength, ult., 400,000 lb. per sq. in.; medium ductility; good bearing and magnetic properties; used for high-speed bearings and cams, valve seats, etc.

L

- - - - - 6 - - - -

LEDALOYL—Johnson Bronze Co., New Castle, Pa. Self-lubricating bearing bronze, pre-alloyed; contains lead which eliminates harshness and provides conformability for misalignment; combination of lead and graphite plus oil content make it useful where lubrication is remote or likely to be forgotten.

See advertisement, Page 157

- - - 4 - - - - - -

LIGHTWELD—Lincoln Electric Co., Cleveland. Arc-welding electrode made for fabrication of chain and gear guards and other machine parts of light gage steel.

- 2 - - - - - - - -

LO CRO—Crucible Steel Co. of America, New York.

Type 501; stainless steel containing over .1 carbon, and 4-6 chrome.

Type 502; stainless steel containing .1 max. carbon, and 4-6 chrome.

- - - - - 6 - - - -

LOTUS BABBITT—Lumen Bearing Co., Buffalo. Lead base bearing babbitt.

- - - - - 6 - - - -

LUBRICO—Buckeye Brass & Mfg. Co., Cleveland. Copper 75, lead 20, tin 5 per cent; for bearings, bushings and bars.

See advertisement, Page 101

- - 3 4 5 - - 8 - 10

LUKENS—Lukens Steel Co., Coatesville, Pa.

2 per cent nickel steel; in plates and spun and pressed heads; for hot forging, stamping, welding, riveting, turning, boring, etc., into many types of machine parts where a high-tensile steel of good ductility is required.

- - - 4 - - - 8 - -

Carbon-molybdenum steel; in plates and spun and pressed heads for hot forging, stamping, welding, riveting, turning, boring, etc.; for machine parts requiring a high-strength steel which retains its strength under conditions of elevated temperature operation.

- - 3 4 - - - - - -

Abrasion-resisting steel; furnished same as above, for use in a variety of parts requiring resistance to wear or abrasion.

- - 3 - 5 - - - - -

Gear rim steel; furnished same as above; abrasion and wear-resisting; originally developed for use in rims of welded gear blanks, as well as other machine parts.

- - - 4 5 - - - - -

Chrome-manganese steel; furnished same as above; tensile strength 100,000 lb. per sq. in.; used principally in fan blades and fan rings.

- - - - 5 - - - - -

3½ per cent nickel steel; furnished same as above; tensile strength 70,000 lb. per sq. in.; used where good resistance to impact is desired in parts operating in sub-zero temperatures.

- - - 4 5 - - - - -

Manganese-vanadium steel; furnished in same as foregoing; high-tensile steel with good welding properties, used in construction of antiaircraft gun mounts and carriages as well as military tank parts.

- - - 4 5 - - - - -

Manganese steel—titanium treated; furnished in same as foregoing; high tensile steel with good welding properties, used military and naval construction.

- - 3 4 - - - - - -

Manganese-molybdenum steel; furnished same as foregoing; tensile strength 95,000 lb. per sq. in.; for use in parts in which abrasion and high tensile strength is desirable.

1 - - - 5 - - - - 10

Nickel-clad, Super nickel-clad, Inconel-clad and Monel-clad steels are all clad metals or bi-metals consisting of light layer of corrosion-resistant super-nickel, nickel, Inconel or Monel bonded to a heavier base plate of steel. All are corrosion resistant and are used in variety of machine parts where this property is desirable.

1 2 - 4 5 6 7 8 9 -

LUMEN ALLOYS—Lumen Bearing Co., Buffalo. (Note: "Lumen Alloy," together with each of the following numbers and grades, is a copyrighted term which should be used in specifying these materials. Thus, "Lumen Alloy No. OOA," etc.)

- - - - - 6 - - - -

Nos. 00A and 00C; high tin bronzes for high compression bearing applications.

- - - - 5 - - - - -

No. 1; zinc bronze for pressure castings including spur and bevel gears.

- - - 4 - 6 - - - -

No. 2; zinc bronze for machine parts, bearings, etc.

1 - - - - 6 - - - -

No. 3; zinc bronze for mine service and paper mill machinery and bearings.

- - - - - 6 - - - -

No. 4; phosphor bronze (leaded), for bearings.

- - 3 - - 6 - - - -

No. 4 chill cast; for heavy-duty bearings, etc.

No. 4A; high-phosphorus bronze (leaded), for bearings on hard steel.

- - - 4 - - - - - -

No. 5; general service casting alloy; red brass; for low pressure valve bodies, etc.

- - - - - - 7 - - -

No. 7; phosphor bronze; uses include trolley wheels and castings to be nickel or chromium plated.

- - - 4 5 - 7 - - -

No. 9; manganese bronze for machine parts requiring strength, electrical conductivity, and high pressure.

1 - - 4 - - - 8 - -

No. 11-C; (sand cast) aluminum bronze; for miter, bevel gears and bearings subject to impact.

1 2 - 4 - - - - - -

No. 11-C; (heat treated) tensile strength 65-100,000 lb. per sq. in.; recommended where strength, corrosion and heat resistance are required.

- - - - - 6 - - - -

No. 14; zinc bronze, babbitt backing; for valve bodies, etc.

1 - - - - 6 - - - -

No. 15; phosphor bronze; for worm wheels, bearings, etc.

No. 15 chill cast; for worm gears, nuts and bearings.

- - - - - 6 - - - -

No. 15A; phosphor bronze (slightly leaded); for worm wheels, bearings, etc.

No. 15-A chill cast; for heavy-duty bearings and worm gear castings.

- - - 4 - - - - - -

No. 20; super-manganese bronze; for machine parts requiring extra strength.

1-Corrosion resistant | 2-Heat resistant | 3-Abrasion resistant | 4-High tensile strength | 5-High ductility | 6-Bearing application | 7-Electrical uses | 8-Heat treating | 9-Low specific gravity | 10-Machinability

1 - - 4 - - - 8 - -
No. 27; (sand cast) aluminum bronze; for strength and corrosion resistance.

1 - - 4 - - - - - -
No. 27; (heat treated) for extreme tensile strength and shock resistance.

- - - - - 6 - - - -
No. 31; for high-speed, low-duty bearings.

No. 33; for bearings, high-speed, low-duty.

- - 3 - - 6 - - - -
No. 43; nickel-tin-bronze alloy for bearings, gears and nuts; abrasion-resistant.

No. 43 (chilled); nickel tin bronze for bearings, worm gears and nuts with higher tensile strength than No. 43.

1 - - - - 6 - - - -
No. 48; nickel-phosphor-bronze; for bearings used with hardened steel, worm wheels, etc.

- - - - - 6 - - - -
No. 48 chill cast; for bearings, worm gears, nuts, slippers, etc.

- - - - - 6 - - - -
No. 54; phosphor bronze (leaded) for bearings and worm wheels for intermediate service. No. 54 chill cast; for bearings, worm gears, nuts etc,

1 - - 4 - - - - - -
No. 96; aluminum bronze, approximately 88 per cent copper, 8.5 aluminum and 3.5 iron; ult., tensile strength, 73,000 lb. per sq. in.; yield point, 25,000 lb. per sq. in.; hardness, 114-121 brinell; specific gravity, 7.7; and has medium abrasion resistance.

- - - - - 6 - - - -
Old Genuine Babbitt; high-strength ingot babbitt for bearings.

- - - - - 6 - - - -
Cosmos Babbitt; ingot materials for bearings.

- - - - - 6 - - - -
Bronze; a zinc base alloy for bearings.

LYNITE—Aluminum Co. of America, Pittsburgh. Aluminum forged and cast products including pistons.

M

- 2 3 4 - - - - - -
MCA-MOLYBDENUM—Molybdenum Corp. of America, Pittsburgh. For use in steel and iron; gives toughness, strength, ductility and resistance to abrasion and improves fatigue value. Increases physical properties at elevated temperatures. Molybdenum steel is easily machined and welded.

See advertisement, Page 94

1 - 3 - - - - - - -
MD METAL POWDERS—Metals Disintegrating Co. Inc., Elizabeth, N. J. Alloy, antimony, aluminum (grain), bismuth, brass, bronze, cadmium, chromium, copper, iron, lead, manganese, molybdenum, nickel, silicon, silver, solder, tin, titanium, tungsten and zinc metal powders, having properties such as elimination of machining, compositions impossible to obtain by conventional methods, high surface area, catalytic work, etc.

1 - 3 - - - - - - -
MRCO METAL POWDER—Metals Refining Co., Hammond, Ind. Metal powders furnished in the following grades:

40 RL; copper 99.4; all passing in a 40-mesh sieve, not over 20 per cent passing a 200 mesh screen; has apparent density of 2.5 grams per cu. cm.; used in commutator brushes, chemical porous filters, catalyzers, and pressed metal compositions.

100 RXA; copper 99.4; all passing a 100-mesh screen; not over 45 per cent passing a 325-mesh screen; has apparent density of 2.7 grams per cu. cm.; used in porous metal bearings, intricate pressed metal shapes, electrical commutator brushes, etc.

150 RXA; copper 99.4; all passing a 150-mesh sieve, not over 75 per cent passing a 325 mesh sieve; has apparent density of 2.7 grams per cu. cm.; for same applications as 100 RXA.

200 RL; copper 99.4; all passing a 200 mesh sieve, and not less than 85 per cent passing a 325 mesh sieve; used in chemical equipment, special commutator brushes, small pores in porous bearing compositions; also has advantages for copper brazing and coating welding rods.

500 RL; copper 99.4; all passing a 325 mesh sieve, and substantially all particles are less than 15 microns in dia.; for use where extremely fine particle size is desired, in brazing and coating, also as clutch facings, etc.

100 A; iron 96; all passing a 100-mesh sieve, not over 40 per cent passing a 325 mesh sieve; has apparent density of about 1.8-2.0 grams per cu. cm.; for pressed parts such as gears, filters, catalyzers, pressed ferrous metal compositions; electromagnets, etc.

100 B; iron 96 min., all passing a 100-mesh sieve, and 50 to 70 per cent passing a 325-mesh sieve; has apparent density of 2.3 to 2.5 grams per cu. cm.; used for the same purpose as 100A iron.

F; lead 99.7; all passing a 200-mesh sieve and substantially all particles less than 20 microns in dia.; used for same applications as 100 B.

- - - - - 6 - - - -
MACHINEBRONZE—Lumen Bearing Co., Buffalo. Zinc bronze; cored and solid bars for bearings.

- - - - - 6 - - - -
MAGNOLIA—Magnolia Metal Co., Elizabeth, N. J.

Antifriction metal; lead-tin-antimony plus special fluxes, furnished in ingots; tensile strength, ult., 15,000 lb. per sq. in.; compressive strength, ult., 20,650 lb. per sq. in.; bearing properties, good; brinell hardness, untreated 21.8; used for bearings.

Isotropic die cast bronze bar stock; copper 80, tin 10, lead 10, and other alloys to suit conditions; furnished in cored bars; resists corrosion caused by acids; resists heat to 900 degrees Fahr.; tensile strength, ult., 31,500 lb. per sq. in.; compressive strength, ult., 26,000 lb. per sq. in.; bearing properties, good; brinell hardness, untreated 70; used for bearings.

- 2 3 - - - - - - -
MALLIX—National Malleable & Steel Castings Co., Cleveland. Pearlitic malleable iron; tensile strength 75,000 lb. per sq. in., elongation 5 per cent; for grate bars for sintering machines, elevator buckets, screen plates for pan mills and other castings subjected to heat, abrasion and shock.

- 2 - 4 - 6 7 - - -
MALLORY—P. R. Mallory & Co. Inc., Indianapolis.

- 2 - - - 6 7 - - -
3 Metal: a copper-chromium-lithium alloy; used extensively for spot, flash and seam welding cold-rolled steel, stainless steel, nickel alloys and Monel metal, silicon bronze alloys, zinc, nickel, silver and other materials employed in applications where a high-strength, high-conductivity material is required; available in rods, bars, strips and castings.

- 2 - 4 - - 7 - - -
53B Metal; copper base alloy furnished in castings and forgings only; tensile strength 60-70,000 lb. per sq. in.; used for heavy-duty butt seam welding wheels, flash welding dies, bearings and current and heat-carrying members in electrical and other machinery.

73 Metal; rough and finished bars, sheets, castings and forgings; containing 95 per cent copper; resists sea water; 110-170,000 lb. per sq. in. tensile strength; used for bearings and bushings, vibrator arms, springs, spring washers and electrodes for projection welding.

100 Metal; rough and finished bars, castings and forgings, containing 95 per cent copper; recommended for high loaded small gears, current-carrying bearings, springs and other details.

1000 Metal; predominantly tungsten; furnished in finished parts or blanks; ult. tensile strength, 100,000 lb. per sq. in.; impact resistance, medium; hardness, 32-40 Rockwell C; specific gravity, 16.9-17.1; nonmagnetic; heat resistant up to 300 degrees Cent.; abrasion resistance, high; for small counter weights, gyroscope rings, etc.

1 2 3 - - - - - - -
MANGANWELD—Lincoln Electric Co., Cleveland. Arc welding electrode that produces deposit of austenitic manganese-nickel-molybdenum steel; suitable for hard facing austenitic manganese steel parts containing 11-14 per cent manganese, such as crusher parts, valves, turbine runners, pulverizer roll shafts, gathering and loading equipment.

1 - 3 - - 6 - - - -
MARTIN STEEL—Detroit Alloy Steel Co., Detroit. Furnished as castings. Chromium 12-14, carbon 1.5-1.6, cobalt 1.25, molybdenum 1.25; semiresistant to corrosion; high heat resistance; high abrasion resistance; tensile strength, ult., 115,000 lb. per sq. in.; compressive strength, ult., 375,000 lb. per sq. in.; medium ductility; good bearing and magnetic properties; brinell hardness, untreated 220, heat treated 600; for use as high speed bearings, cams, valve seats, spindles, etc.

- - 3 4 - - - - - -
MASSILLON—Massillon Steel Casting Co., Massillon, O. Alloy cast steel, heat treated; for domestic, industrial and locomotive stoker worms.

- - - 4 5 - - - - -
MAX-EL—Crucible Steel Co. of America, New York.

1-B; carbon .20, with high manganese and low molybdenum; excellent machining and uniformity in carburizing response; used for automobile parts, machine tool parts, gages, sprockets, etc.

2-B; carbon .35-.45, and otherwise identical in analysis to 1-B; used in "as rolled" condition for machine tool spindles, lead screws, racks, worms, piston rods, etc.

3½ for heat-treated parts on machine tools, such as gears, arbors, spindles, etc.

1 2 3 4 - - - - - -
MAYARI—Bethlehem Steel Co. Inc., Bethlehem, Pa.

A; a nickel-chromium series of steels, corresponding to S.A.E. 31XX series, suitable for heat-treated parts. Furnished in various carbon ranges for carburizing, water and oil-hardened parts.

B; a nickel-chromium steel furnished as bolts and sucker rods, having good atmospheric corrosion resistance combined with moderate strength, used in heat-treated condition.

R; a low-carbon, high-strength nickel-chromium-copper-phosphorus structural steel having good resistance to atmospheric corrosion. Used for structural purposes where weight reduction and corrosion resistance are desired.

1 - - 4 5 - - - 9 10
MAZLO Magnesium Alloys—American Magnesium Corp., Cleveland. Available in sand, permanent mold and die castings, rolled sheet, extruded bar, shapes and structural sections, and forgings.

1 - - 4 - - - - - 10
AM260; aluminum 9, zinc 1, manganese .1, magnesium remainder. Heat-treatable alloy for sand and permanent mold castings. For moving parts on high-speed production equipment and wherever pressure tightness and good strength are needed. Improved salt water resistance.

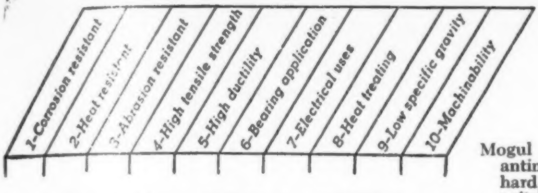
AM265; aluminum 6, zinc 3, manganese .15, magnesium remainder. Used for high-strength sand castings with good chemical stability.

- - - 4 - - - - - -
AM230; aluminum 10, silicon .7, magnesium remainder. Used for pressure die castings for parts requiring light weight and thin sections.

AM263; aluminum 9, zinc .6, manganese .1, magnesium remainder. Used for pressure die castings for lightweight parts in portable or fast-moving equipment.

- - - 4 5 - - - - -
AM-C57S; aluminum 6, zinc 1, manganese .15, magnesium remainder. Used for extruded bars, tubes and rolled sheet for lightweight applications in general.

AM3S; manganese 1.2, magnesium remainder. Used for sheet, strip, extruded shapes, sand castings, and hammer forgings of moderate strength for uses requiring maximum salt



water resistance. Suitable for fabricated articles such as aircraft oil tanks and cowlings.

AM-C52S; aluminum 3, zinc 1, magnesium remainder. Used for rolled sheet and extrusions of light weight. Good welding and forming characteristics and salt water resistance.

AM58S; aluminum 8, zinc .8, manganese .15, magnesium remainder. Used for hot press forgings for parts under stress especially for aircraft and aircraft engine applications.

AM65S, aluminum 3.5, tin 5, magnesium remainder. Used for hot press forgings of moderate strength and lightness.

See advertisement, Page 165

1 - 3 4 5 - - - - - 10

McGill—McGill Mfg. Co., Valparaiso, Ind.

1 - - 4 5 - - - - - -

No. 1 McGill Metal; aluminum-bronze alloy, suitable for pump liners, gears, corrosion-resistant castings and parts requiring strength, toughness with minimum weight.

1 - 3 - - - - - - 10

No. 2; McGill silicon-bronze; corrosion-resistant; resists heat to 500 degrees Fahr.; medium abrasion resistance; tensile strength 95,000 lb. per sq. in.; brinell hardness, untreated 160-180.

1 - - 4 - - - - - - -

No. 4 McGill bronze hydraulic pressure castings; finished casting tolerance of plus or minus .005.

- 2 3 4 - - - - - - -

MEEHANITE—Meehanite Metal Corp., Pittsburgh, and licensees as listed hereunder. A sorbo-pearlitic iron containing silicon, manganese, phosphorus, sulphur and carbon, composition depending upon mixture and physical constitution as determined by service requirements; twenty-five grades, some of which can be heat treated, and flame hardened, each having a separate and distinct combination of physical properties; available in cast form; for machinery and miscellaneous castings.

Licensees include the following: American Brake Shoe & Fdy. Co., Mahwah, N. J.; Atlas Foundry Co., Detroit; Banner Iron Works, St. Louis; E. W. Bliss Co., Brooklyn; H. W. Butterworth & Sons Co., Bethayeres, Pa.; M. H. Detrick Co., Newark, N. J.; The Elliott Co., Jeannette, Pa.; Farrel Birmingham Co., Ansonia, Conn.; Otis Fenson Elevator Co., Hamilton, Ont.; E. Long Ltd., Orillia, Ont.; General Electric Co., Ontario, Calif.; Valley Iron Works Inc., St. Paul; Greenlee Foundry Co., Chicago; American Laundry Machinery Co., Rochester, N. Y.; Cincinnati Milling Machine Co., Cincinnati; Cooper Bessemer Corp., Grove City, Pa., and Mt. Vernon, O.; Crawford & Doherty Foundry Co., Portland, Oreg.; Florence Pipe Foundry & Machine Co., Florence, N. J.; The Newark Stove Co., Newark, O.; Fulton Foundry & Machine Co. Inc., Cleveland; General Foundry Mfg. Co., Flint, Mich.; Stearns-Roger Mfg. Co., Denver, Colo.; Hamilton Foundry & Machine Co., Hamilton, O.; Kanawha Mfg. Co., Charleston, W. Va.; Barnett Foundry & Machine Co., Irvington, N. J.; Henry Perkins Co., Bridgewater, Mass.; Pohlman Foundry Co., Buffalo, N. Y.; Rosedale Foundry & Machine Co., Pittsburgh; Warren Foundry & Pipe Corp., Phillipsburg, N. J.; Kinney Iron Works, Los Angeles; Koehring Co., Milwaukee; Marshall Stove Co., Lewisburg, Tenn.; Vulcan Foundry Co., Oakland, Calif.; Ross-Meehan Foundries, Chattanooga, Tenn.; Vancouver Engrg. Works, Vancouver, B. C.; Washington Iron Works, Seattle; Washington Machinery & Supply Co., Spokane, Wash.

See advertisement, Page 201

- 2 - - - 6 - - - - -

METALINE—R. W. Rhoades Metaline Co. Inc., Long Island City, N. Y. Lubricating insert plugs of several diameters and lengths and in varied compositions for rendering bronze bearings and bushings oilless. Also bronze bearings complete in which Metaline plugs are inserted, furnished in form of finished bearings.

- - - - - 6 - - - - -

MOGUL BABBITT—Federal-Mogul Corp., Detroit.

Mogul alloy genuine babbitt; made from tin, antimony and copper, virtually lead free; hard, tough alloy; high tensile strength; suitable for die-cast and hand-poured bearings; used for high-speed automobile and aircraft engine, steel and bronze back main and connecting-rod bearings, trucks, tractors, high-speed machinery, planers, and crossheads.

Mogul bearing metal; general all-purpose babbitt for repair and maintenance; for bearings requiring toughness; used for machinery bearings, stationary gas engines, paper mill, rolling mill, rubber plant and brick machinery.

407 nickel babbitt; varying slightly from Mogul genuine babbitt alloy; for applications where speed is fairly high and bearings are large, that is 1/16th-inch or more in thickness; used in woodworking machinery and other heavy-duty types.

408 special babbitt (copper-hardened); originally produced for electric railway armatures, now used for special bearing applications; has great durability and will stand up under hard wear; used in motor pumps, motor shafts, rock crushers and forming presses.

Duro antifriction metal; while softer and less tough than Mogul bearing metal (above), compares favorably with lead base general purpose babbitts; used for flour mill, laundry, canning and bottling machinery, pump packing, slow-moving pulleys and axle bearings.

Special "B"; a lead and antimony alloy; free of usual nonbearing ingredients; used for slow-speed bearings of all kinds and heavy line shafting.

- - 3 - - - - - - - -

MOLYBDENITE—Continental Roll & Steel Foundry Co., East Chicago, Ind. Special chrome-molybdenum-steel castings for mill pinions, guides and rolls.

See advertisement, Page 167

- 2 3 4 - - - - - - -

MO-LYB-DEN-UM—Climax Molybdenum Co., New York. An alloying element for use in steel and iron; imparts strength, toughness, ductility and resistance to abrasion; improves fatigue value, eliminates temper embrittlement, increases physical properties at elevated temperatures; molybdenum steel is easily welded and machined.

See advertisement, Page 169

- - 3 - - - - - - - -

MO-MANG—American Manganese Steel Div., The American Brake Shoe & Foundry Co., Chicago Heights, Ill. Manganese 12-14, carbon .7-.9, with molybdenum; welding rod for building up manganese steel and other ferrous castings.

- 2 3 4 - - - - - - -

MO-MAX—The Cleveland Twist Drill Co., Cleveland. A high-speed steel, in rough bars or billets, finished rods or bars, wire and sheets, for hot forging, turning, boring, welding, etc.; resists heat to 1100 degrees Fahr.; high abrasion resistance; high tensile strength; good bearing properties; specific gravity about 7.95; good weldability; brinell hardness, untreated 220, heat treated 700; for use where great strength and wear resistance up to temperatures of 1000 degrees Fahr. are required such as gears, cams, guides, wearing plates, etc. Licensees are: Allegheny Ludlum Steel Co., Atlas Steels Ltd. (Canada), Bethlehem Steel Co., Braeburn Alloy Steel Corp., Carpenter Steel Co., Crucible Steel Co. of America, Henry Disston & Sons Inc., Halcomb Steel Div., Crucible Steel Co. of America. Jessop Steel Co., Latrobe Electric Steel Co., Universal-Cyclops Steel Corp., Vulcan Crucible Steel Co., Simonds Saw & Steel Co., and Columbia Tool Steel Co.

1 2 3 4 5 - - 8 - 10

MONEL—The International Nickel Co. Inc., New York. Nickel 67, copper 30, iron 1.4, manganese 1, silicon .1, carbon .15, sulphur .01; general purpose corrosion-resistant, high-strength, rust proof alloy; used for applications requiring protection against chemical reaction, high mechanical properties and attractive appearance.

- - 3 4 - - - 8 - -

K Monel; nickel 66, copper 29, iron .9, manganese .85, silicon .5, carbon .15, sulphur .005, aluminum 2.75; heat-treatable alloy affording corrosion and abrasion resistance plus mechanical properties comparable to those of heat-treated alloy steels; nonmagnetic; for parts requiring corrosion resistance with high mechanical or nonmagnetic properties.

1 - 3 4 - - - - - -

KR Monel; chemical composition, resistance to corrosion, mechanical, magnetic and heat-treating properties same as those of K Monel; high ductility; has improved machinability. Available only in rod and wire forms.

- - - 4 5 - - - - - 10

R Monel; nickel 67, copper 30, iron 1.7, manganese 1.1, silicon .05, carbon .1, sulphur .035; for parts requiring corrosion and abrasion resistance combined with free-cutting qualities permitting high-speed automatic machine work.

- 2 - 4 - - - 8 - -

S Monel; nickel 63, copper 30, iron 2, manganese .9, silicon 4, carbon .1, sulphur .015; high-strength, corrosion and abrasion-resistant material for castings requiring extra hardness for resistance of galling and seizing.

See advertisements, Pages 119, 161

- - - - - 6 - - - - -

MORAINE—Moraine Products Div., General Motors Corp., Dayton, O. Rolled bronze split-type bearings and bushings for automobiles, electric motors and farm implements.

1 2 - - - 6 - - - -

MORGANITE—Morganite Brush Co. Inc., Long Island City, N. Y. Carbon-graphite, and carbon-graphite-metal mixtures; in finished rods or bars and plates, for turning, boring, molding, etc.; resists corrosion caused by any liquid handled industrially; resists heat to 700 degrees Fahr.; good abrasion resistance; tensile strength, ult. 1000-3000 lb. per sq. in.; compressive strength, ult., 10,000-30,000 lb. per sq. in.; ductility, low; specific gravity, 2-2.15; used for bearings, valves, seals, nonfriction slides, piston rings, etc.

See advertisement, Page 163

1 - 3 4 - - - - - - -

MUELLER 600 Bearing Metal—Mueller Brass Co., Port Huron, Mich. Copper 56-60, lead .5 max., manganese 1.25-3.5, aluminum .5-2, silicon .5-1.2, iron .6 max., and remainder zinc; sold as extruded or extruded and drawn, and rods and bars, and as die forgings from rod. Tensile strength, 70-85,000 lb. per sq. in.; yield point (½ per cent extension) 45-50,000 lb. per sq. in.; elongation, in 2 inches, 20 to 10 per cent for die forgings. Specific gravity, 8.071; conductivity about 12 per cent of copper; nonmagnetic; good corrosive resistance against sea water; used as low speed heavily loaded bearings as it withstands damage from lubricants carrying considerable sulphur compounds. Used for high-speed bearings on hardened matting surfaces, cam faces and machine parts subject to wear, such as pump rods and shafts, and forged connecting rods for high-speed service.

See advertisement, Page 108

- - - - - - 7 - - -

MUMETAL—Allegheny Ludlum Steel Corp., Pittsburgh. Furnished in sheets, coiled strips and laminations for stamping, forming and drawing. Nickel 71-76, copper 4.5-6, chromium 2 max., balance iron. Has high permeability qualities; recommended heat treatment, 1800-2000 degrees Fahr. in stream of pure dry hydrogen; used for audio-transformers, sensitive relays and electrical instruments.

See advertisement, Page 99

1 - 3 4 - - - - - - -

MUREX—Metal & Thermit Corp., New York A series of welding electrodes designed for welding mild steel carbon-molybdenum steel U.S.S. Cor-Ten and Mayari, Cromansil, nickel steels, chrome-molybdenum, chrome-nickel, straight chrome, manganese, stainless and high-carbon steels and for building up and hard surfacing.

N

1 - - 4 5 - - - - - -

N-A-X HIGH TENSILE—Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Detroit. Carbon .1-.18, manganese .6-.75, silicon .65-.9, copper .25 max., chromium .5-.65, nickel .1-.25, molybdenum .15 max., zirconium .1-.15, sulphur .04 max., phosphorus .04 max.; in rough bars or billets,

1-Corrosion resistant / 2-Heat resistant / 3-Abrasion resistant / 4-High tensile strength / 5-High ductility / 6-Bearing application / 7-Electrical uses / 8-Heat treating / 9-Low specific gravity / 10-Machinability

finished rods or bars, sheets, strips and plates; corrosion-resistant; resists heat to 700 degrees Fahr; medium abrasion resistance; tensile strength 75-85,000 lb. per sq. in.; high ductility; good bearing properties and weldability; brinell hardness, untreated 149-156, heat treated 230-375; used for machine parts where high torsional properties, high tensile strength and resistance to fatigue and notch impact at normal and sub-zero temperatures are required.

1 2 3 - - - - - - - -
NA, NA-1, NA-2—National Alloy Steel Division, Blawnox, Pa. Varying percentages of nickel and chromium.

- - 3 4 - - - - - -
NACO—National Malleable & Steel Castings Co., Cleveland. Specialty processed cast steel; for service where heavy blows and constant friction require a material that combines great strength, toughness and resistance to wear; used in chains for steam shovel, dragline, draft gears, railway equipment.

- - - 4 - - - - 8 - 10
NATIONAL Graphitic Steel—National Malleable & Steel Castings Co., Cleveland. High-strength steel furnished in castings. Has medium abrasion resistance, minimum tensile strength, 75,000 lb. per sq. in., average; can be flame hardened, average brinell hardness, 200; used for automotive and other medium size castings requiring high strength and good machinability.

- - - 4 - - - - - -
NELOY—National-Erie Corp., Erie, Pa. Steel castings, rough, finished, machined or flame hardened; high strength and hardness due to combination of alloying and special hardening; high abrasion resistance. Used for various applications in rolling mills and steel works equipment, overhead traveling cranes, power shovels, drag lines, and other heavy machinery.

- - 3 - - - - 7 - 9 -
NEOR—Darwin & Milner Inc., Cleveland. High-carbon, high-chrome steel; carbon 2.25, chromium 13, vanadium .2, manganese .4, silicon .5 and nickel .5; in rough bars or billets, finished rods and bars; for hot forging, turning and boring. Mechanical properties in heat-treated state are ult. tensile strength, 160 000 lb. per sq. in.; compressive, 240 000 lb. per sq. in.; yield point (untreated) 66 000 lb. per sq. in.; elongation (annealed) 9 per cent; impact resistance, low; hardness, up to 66 Rockwell C; specific gravity, 7.76; magnetic; heat resistant to 1400 degrees Fahr.; abrasion resistance, very high; used for slitting cutters, lamination dies, etc.

1 - - - - - - - 8 - 10
NEY-ORO G—The J. M. Ney Co., Hartford, Conn. Gold-platinum-silver-copper alloy in wire, sheets, coiled strips, and plates; for stamping, turning, boring, welding and soldering. Mechanical properties in heat-treated state: ult. tensile strength, 160,000 lb. per sq. in.; yield point, 154,000 lb. per sq. in.; elongation, 6 per cent; impact resistance, high; hardness, 280 brinell; non-magnetic; weldability, good; abrasion resistance, medium; for pivots, small bearings, springs and electrical contacts.

1 2 - 4 5 - 7 - - 10
NICKEL—International Nickel Co. Inc., New York.

Nickel; nickel 99.4, copper .1, iron .15, manganese .2, silicon .05, carbon .1, sulphur .005; rustproof, corrosion-resistant chemical parts.

- - - 4 5 - - - - 10
L Nickel; a low carbon type of nickel, otherwise similar in chemical composition to nickel. Especially suitable in contact with fused caustic and certain fused salts; corrosion and heat resistant.

- - - 4 5 - - - - 10
D Nickel; nickel 95.2, copper .05, iron .15, manganese 4.5, silicon .05, carbon .1, sulphur .005, a metal similar to nickel but affording superior mechanical properties and resistance to atmospheric attack at elevated temperatures; corrosion and heat resistant; for electrical uses.

- - - 4 5 - - 8 - -
Z Nickel; nickel 98; heat-treatable material resembling nickel except for its higher mechanical properties which are comparable to those of oil-tempered spring steel; corrosion resistant; used for products requiring spring properties coupled with corrosion resistance.

See advertisement, Pages 119, 161

1 - - 4 5 - - - - -
NICKELCHROMEWELD—Lincoln Electric Co., Cleveland. Heavily coated electrode of shielded arc type for welding of Inconel, Nichrome and other similar alloys of 70-80 per cent nickel, 11-15 per cent chromium and 5-10 per cent iron.

1 - - - 5 - - - - -
NICKELOID—American Nickeloid Co., Peru, Ill., Nickel bonded to zinc, latter serving as rust-proof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum-adhered paper covering permitting drawing and forming without marring prefinish.

1 - - 4 - - 7 - - -
NICUITE—A. W. Cadman Mfg. Co., Pittsburgh, Nickel bronze; tin 10, nickel 3.5, zinc 2.5, trace of phosphorus, balance copper; high compressive strength for slow or medium speed operation under extreme pressures.

- - 3 - - - - - - -
NI-HARD—International Nickel Co. Inc., New York, and licensees. Nickel 4.5, chromium 1.5, total carbon 2.7-3.6; cast iron for chilled rolls, grinding balls, mill liners, etc., where abrasion is encountered.

See advertisement, Pages 119, 161

1 2 - - - - - - - -
NI-RESIST—International Nickel Co. Inc., New York and licensees. Nickel 14, copper 6, chromium 2, total carbon 2.60-3.10, silicon 1.25-2, manganese 1-1.5; for castings handling corrosive waters and other solutions, or heats above the range of temperature where ordinary cast iron gives good service; resists corrosive vapors, gases and liquids; recommended instead of plain cast iron under such conditions.

See advertisement, Pages 119, 161

- - - 4 - - - - - 10
NI-TENSYLIRON—International Nickel Co. Inc., New York, and licensees. Nickel 1-4, total carbon 2.5-3.15, silicon 1.2-2.75, manganese .5-.9; for machine tool castings, diesel engine housings, auto cylinder blocks, pistons, etc.

See advertisement, Pages 119, 161

1 - 3 4 - - - - - -
NITRALLOY—Nitralloy Corp., New York, controls nitriding process and licenses under which alloy is produced. A chromium-molybdenum-aluminum steel capable of developing extreme hardness through nitriding; for cams and camshafts, gears, pump parts, splined shafts, cylinder liners, etc. Licensees include Allegheny Ludlum Steel Corp., Bethlehem Steel Co., Crucible Steel Co. of America, Firth-Sterling Steel Co., Republic Steel Corp., The Timken Roller Bearing Co., Vanadium Alloys Steel Co., Copperweld Steel Co., and Atlas Steels Ltd.

See advertisement, Page 190

1 2 3 - - - - - - -
NUREX—National Malleable & Steel Castings Co., Cleveland. A chromium-manganese-carbon alloy furnished in castings; resists corrosion caused by dilute aqueous solutions and acids (except phosphoric); resists heat to 1700 degrees Fahr.; abrasion resistance, high; ductility, low; used for mill balls, lining and similar purposes.

O

- - - - - - 7 - - -
OHMALOY—Allegheny Ludlum Steel Corp., Pittsburgh. Furnished in sheets, coiled strip, wire and rods, for stamping, turning and boring. Chromium 12-14, aluminum 4-4.75, balance iron. Has high electrical resistivity; magnetic properties moderate; resists oxidation to 2000 degrees Fahr. Anneals at 1350-1450 degrees Fahr. Used for electrical resistor grids and wire wound resistors, also edge-wound strip resistor.

See advertisement, Page 99

- - - - - 6 - - - -
OILITE—Chrysler Corp. Amplex Div., Detroit, Mich. Oil cushion, heavy-duty bronze bearings containing one-third oil by volume; used extensively in aircraft, aircraft instruments, tanks, trucks, etc.

Super-Oilite; a porous oil cushion extreme pressure self-lubricating bearing permitting an allowable bearing load of 50,000 lb. per sq. in. under zero velocity; furnished as finished parts or in bars, plates, and irregular shapes; good bearing properties; high porosity oil cushion; high strength and ductility; self-lubricating; used for aircraft controls, landing gear, locomotives, etc.

Super-Oilite "16"; a porous oil cushion extreme high-pressure self-lubricating bearing with an allowable bearing load of 100,000 lb. per sq. in. under static load; has high oil content, extreme hardness with an allowable bearing load exceeding 100,000 lb. per sq. in. under zero velocity, and excellent bearing qualities; for bearing applications.

Iron-Oilite; a porous pure iron self-lubricating bearing, oil impregnated; copper free, porous oil cushion bearing; resists corrosive effects of sulphur, its compounds and similar agents; used for bearings in pumps.

Aluminum-Oilite; a porous lightweight self-lubricating oil impregnated bearing; porous; eliminates galvanic action with surrounding aluminum housings often discovered with bearings which form a galvanic cell with aluminum; used for bearings for aircraft controls, and wherever lightness is important.

NDHTC-Oilite; a ferrous, nonporous high-density material used as parts and shapes; tensile strength, ult., 80,000 lb. per sq. in.; readily machined; heat treatable; high magnetic properties.

1 - - - 4 5 - - - -
OLYMPIC BRONZE—Chase Brass & Copper Co., Waterbury, Conn.

Type A; copper 96, silicon 3, zinc 1; tensile strength, 55-150,000 lb. per sq. in.; brinell hardness 70-200; annealed at 1100-1200 degrees Fahr. if necessary to soften for additional cold working; resists corrosion due to saline, acid and alkaline solutions; used for welded structural parts, bolts, nuts, tubing, tie rods, etc.

Type B; copper 97.5, silicon 1.5, zinc 1; tensile strength, 45-90,000 lb. per sq. in.; annealed at 1100-1200 degrees Fahr. if necessary to soften for additional cold working; resists corrosion due to saline, acid and alkaline solutions; used for bolts, nuts, pipe and tubing.

- - - - - 6 7 - - 10
OMAN METAL—Kitson Co., Philadelphia. Virgin copper and lead in proportions of copper 55 and lead 45, to copper 80 and lead 20; in rough bars or billets, finished rods or bars and tubing; fabricated into parts by sand casting, turning, boring, etc. Mechanical properties in untreated state: hardness, 17-25 brinell; specific gravity, 9.5-10; nonmagnetic; heat resistant up to 1900 degrees Fahr.; for heavy-duty steel-backed bearings.

1 - 3 - - - - 7 - - -
OREIDE—Scovill Mfg. Co., Waterbury, Conn. Copper 90, tin .5, balance zinc; in finished rods or bars, tubing, wire, sheets and strips (coiled); for stamping, turning, boring, etc., into machine parts; medium abrasion resistance; tensile strength, 95,000 lb. per sq. in. (hard drawn or rolled); specific gravity, 8.8; bearing properties fair; electrical properties fair; recommended heat treatments, anneal at 975-1025 degrees Fahr.; spring properties good; used primarily for spring contacts and switch parts.

- - - 4 5 - - - - 10
OSTUCO—Ohio Seamless Tube Co., Shelby, O. Precision tubing; seamless and electric-welded. Formerly known as Ohio Special Quality tubing.

1 - - 4 5 6 - - - -
OXWELD—Linde Air Products Co., The, New York.

- - - 4 5 - - - - -
No. 1; welding rod for steel giving welds of high tensile strengths up to 70,000 lb. per sq. in.

1-Corrosion resistant | 2-Heat resistant | 3-Abrasion resistant | 4-High tensile strength | 5-High ductility | 6-Bearing application | 7-Electrical uses | 8-Heat treating | 9-Low specific gravity | 10-Machinability

\- - - - 5 - - - - -

No. 7; drawn iron welding rod giving welds where high tensile strength is not a factor.

No. 9; cast iron rod (round) for gray iron castings.

1 - - - 5 - - - - -

No. 23; welding rod for cast aluminum and aluminum alloys, giving high tensile strength.

\- - - 4 5 6 - - - -

No. 25M; bronze welding rod having brinell hardness of 96 and high tensile strength.

No. 28; a columbium bearing welding rod suitable for 18-8 stainless steel.

See advertisement, Page 193

P

1 - - - - - - - 8 - 10

PALINEY—The J. M. Ney Co., Hartford, Conn.

No. 6; lead-platinum-silver-copper-nickel alloy; in wire, sheets coiled strips, and plates for stamping, turning, boring, welding and soldering. Mechanical properties in heat-treated state: ult. tensile strength, 170,000 lb. per sq. in.; yield point, 12,700 lb. per sq. in.; elongation, 15 per cent; hardness, 270 brinell; specific gravity, 10.9; nonmagnetic; abrasion resistance, medium; used for pivots, small bearings, springs, electrical contacts, etc.

No. 7; similar to No. 6 in analysis with the addition of gold; available also in the same form. In heat-treated state, ult. tensile strength, 180,000 lb. per sq. in.; yield point, 14,800 lb. per sq in.; elongation, 9 per cent; impact resistance, high; hardness, 280 brinell; specific gravity 11.9; nonmagnetic; weldability, good; for same uses as foregoing.

1 - 3 - - - - - - - -

PERDURO—The Jeffrey Mfg. Co., Columbus, O. High-strength malleable iron for sand casting; resists corrosion due to analysis and heat treatment; resists heat to 1100 degrees Fahr.; high abrasion resistance; tensile strength, 80,000 lb. per sq. in.; used for cast chains for drive and conveyor service.

1 2 - 4 5 - - - 9 -

PERMITE—Aluminum Industries Inc., Cincinnati. Following grades available as sand castings, and permanent mold castings.

1 2 - 4 - - - - - -

No. 1002; copper 10, iron 1.5, magnesium .4, balance aluminum; for pistons for automotive, pump and refrigeration service.

1 - - 4 5 - - - - -

No. 1010; copper 4, silicon 1, balance aluminum; for machine parts to resist shock; heat treatment is to soak at critical and quench in water, and reheat at 350 degrees Fahr. to desired properties.

1 - - 4 - - - - 9 -

No. 1019; furnished in ingots and sand castings and permanent mold castings; silicon 5, copper 1.25, magnesium .5, balance aluminum; heat treatment, quenching in water; suitable for highly-stressed parts including airplane engine parts.

1 - - - 5 - - - 9 -

No. 2011; silicon 5, balance aluminum; for parts subject to atmospheric corrosion.

1 - - 4 - - - - 9 -

No. 2021; magnesium 4, balance aluminum; for parts subject to salt water corrosion.

1 - - 4 - - - - 9 -

No. 2023; magnesium 10, balance aluminum; for parts subject to high stress; furnished heat-treated.

1 - - - - - - - - -

PITTSBURGH STAINLESS STEELS—Pittsburgh Steel Co., Pittsburgh.

Stainless steels of various chromium-nickel-carbon types; 301, a high tensile material; 302, for food and meat packing equipment; 303, chrome-nickel-selenium type for screw stock; 304, similar to Type 302, advantageous for welded parts; 308, for cold heading requirements; 309, for welding rods where creep strength at elevated temperatures is a factor; 321, an 18-8 material with titanium added, for airplane parts; 347, similar to Type 321 but with better corrosion resistance; 310, chrome-nickel alloy for welding rod applications and where heat resistance is required; 316, chrome-nickel-molybdenum, acid-resistant, for chemical and textile industries; 317, similar to Type 316 but more corrosion-resistant; 410, heat treating type for use where high tensile and high rockwell hardness are desired; 414, similar to Type 410 but with somewhat different physical properties; 416, best machining qualities of these stainless steels but with only fair corrosion-resisting properties; 430, corrosion-resisting and fabricating properties not as good as Type 302, particularly good for trim; 446, high-resisting steel with reasonably high creep strength.

1 - - 4 - - 7 - - -

PHOS-COPPER—Westinghouse Electric & Mfg. Co., East Pittsburgh. Pa., brazing alloy manufactured in rod and strip form, containing 5-7 per cent phosphorus and balance copper; highly corrosion-resistant; gives strong joints when used for brazing copper and copper alloys to each other.

1 - - 4 5 - - - - -

PLANEWELD—Lincoln Electric Co., Cleveland. Shielded arc electrode for welding SAE 4130 and X4130 chrome-moly steels such as are widely used in airplane construction. For welding all positions.

Type No. 1; is intended for use on landing gears, tail wheel assemblies, etc. in metal thicknesses of .120-inch and up.

Type No. 2; is used for airplane tubing and similar construction of light gauges up to about 7/64-inch thickness. It gives a minimum of penetration. Slag is easy to remove.

1 2 - - - - - - - -

PLATINUM-CLAD—Baker & Co. Inc., Newark, N. J. Pure platinum welded to various base metals, in sheet, tubing and wire. Resists corrosion caused by usual acids; medium abrasion resistance; good weldability; tensile strength, ductility, etc., are dependent upon properties of base metals. Used for tubing exposed to acids and for vessels subject to same.

1 2 3 - - - - - - -

PLURAMELT—Allegheny-Ludlum Steel Corp., Pittsburgh. Combination of mild steel and stainless steel; in sheets and plates; for stamping and welding; corrosion resistant; resists heat to 1500 degrees Fahr.; medium abrasion resistance; tensile strength approximately 65,000 lb. per sq. in.; high ductility; good weldability; fair magnetic properties.

See advertisement, Page 99

1 - 3 4 - - - - - -

POMPTON—Allegheny Ludlum Steel Corp., Pittsburgh. Carbon .95-1.05; for arbors, bushings, collets and lathe centers. Water hardening.

See advertisement, Page 99

POREX—Moraine Products Div., General Motors Corp., Dayton, O. Filtering and diffusing material product of powder metallurgy in bronze, iron, and other metals; provides high flow rates, low flow resistance; used in fuel and lubricating systems, instruments, breathers, burners, separators, etc.

1 - - 4 - 6 - - - -

POWDIRON—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J. Porous iron bearing alloys available in three grades. All have high compressive strength.

55P; contains no tin and only 5 per cent copper; used to conserve copper and tin; ult. tensile strength, 12,000 lb. per sq. in.; specific gravity 5.5; compressive strength, 16,000-140,000 lb. per sq. in.; subject to corrosion under certain conditions but due to protective film of oil, will show less tendency to corrode than steel shaft.

61-IC; contains no tin and only 10 per cent copper, and is impregnated with 25 per cent of oil by volume; stronger than other materials furnished by company, and recommended for heavy-duty slower motion requirements where tensile strength is determining factor as in aviation and ordnance industries; ult. tensile strength, 30,000 lb. per sq. in.; compressive strength, 17,-140,000 lb. per sq. in.

59-IC; straight-iron material impregnated with 25 per cent oil by volume, recommended for parts other than bearings which may or may not be sized to close dimensions; smooth mirror finished surface reduces friction; ult. tensile strength, 12,000 lb. per sq. in.; compressive strength, 22-130,000 lb. per sq. in.

See advertisement, Page 183

1 - - - - - - 7 - 9 -

PRECISION—Precision Castings Co. Inc., Syracuse, N. Y.

Type A-12; aluminum base alloy; silicon 12, balance aluminum; resists heat to 1000 degrees Fahr., tensile strength, 33,000 lb. per sq. in.; specific gravity, 2.66; for general aluminum die casting uses.

Type ZN-4; zinc base alloy. Aluminum 1.5, copper 1, magnesium .4, balance zinc. Substitute for ZN-5 to conserve aluminum as directed by WPB Conservation Order M-1-C.

Type ZN-5; Zinc base alloy; aluminum 4, copper 1, magnesium .04, balance zinc; tensile strength, 42,000 lb. per sq. in.; compressive strength, 85,000; specific gravity, 6.71; brinell hardness, 75; for general die casting uses—automotive, washing machines, electrical equipment, etc.

A-50; aluminum base alloy; silicon 5, balance aluminum; furnished as castings; resists corrosion caused by atmosphere, foods, etc., resists heat to 1000 degrees Fahr.; abrasion resistance, medium; tensile strength, ult., 29,000 lb. per sq. in.; ductility, medium; for use where corrosion resistance and ductility are essential.

\- - - - - - - 7 - 9 -

A-54; Aluminum base alloy; silicon 5, copper 4, balance aluminum; furnished as castings; resists corrosion caused by atmosphere, resists heat to 1000 degrees Fahr.; tensile strength, ult., 32,000 lb. per sq. in.; general aluminum die cast parts.

A-74; aluminum base alloy. Silicon 7.5, copper 4, balance aluminum. Substitute for A-54 alloy wherever possible. Conforms to Federal Specification AXS-679. Rev. 2.

\- - 3 4 5 - - - - -

PROMAL—Link-Belt Company, Indianapolis. Specially processed malleable-iron having high yield and fatigue strengths; for resistance to mild corrosive attack can be furnished with copper content; can be hot dip galvanized without embrittlement and can be used in ovens and furnaces up to 1100 degrees Fahr.; uses include conveyor and drive chain links, bearing caps, rocker arms, sheaves, levers and other machine parts subjected to severe service.

\- 2 - 4 - 6 - - - -

PROMET—The American Crucible Products Co., Lorain, O. Heat-treated bronze bearing metal having great compressive strength, low coefficient of friction, lubricating qualities; for bearings and wearing parts.

\- 2 - 4 - 6 - - - -

PYRAMID METAL—Magnolia Metal Co., Elizabeth, N. J. Lead-tin-antimony-arsenic alloy furnished in ingots. Ult. tensile strength, 17,-850 lb. per sq. in.; yield point 8875; hardness, 25 brinell; abrasion resistance, medium; for applications where bearings must withstand heavy sustained pressures such as in marine reciprocating engines, water turbines, paper mill calender stacks and rolling mill machinery.

\- - 3 4 - - - 8 - -

PYTHON—Allegheny Ludlum Steel Corp., Pittsburgh. Carbon .85, vanadium .25; for chuck jaws, clutch pins and other parts requiring unusual wear and shock resistance. Water hardening.

See advertisement, Page 99

1 - - 4 - - - - - -

PYRASTEEL—Chicago Steel Foundry Co., Chicago. Nickel varies from 8 per cent up, chrome from 8.26 per cent; available as castings for heat-treating furnaces, screw conveyors, or any high temperature service to 2200 degrees Fahr. Also available in following grades:

No. 20; nickel 35, chrome 18.

No. 18; nickel 25, chrome 16.

No. 2000; chrome 26-28, nickel 14.

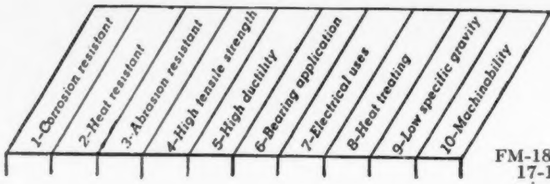
No. 14; chrome 6, molybdenum .5.

All of these grades carry a high silicon content, varying from 1-2.5 per cent.

R

\- - 3 - - 6 7 - - -

RANDALL—Randall Graphite Products Corp., Chicago. S.A.E. No. 64 bronze or as spe-



cified; furnished as sand castings; resists corrosion caused by moisture; resists heat to 700 degrees Fahr.; high abrasion resistance; tensile strength, ult., 30,000 lb. per sq. in.; medium ductility; good bearing properties; conductivity, good; brinell hardness, untreated 80 for use as bushings; graphite-inserted in the perforated or drilled hole, grooved, or reservoir types.

See advertisement, Page 177

\- - - 4 5 - - - - -

READYWELL—Lincoln Electric Co., Cleveland. Welding electrode for use with alternating-current transformer type welders which have low open-circuit voltage. Possesses arc stability with easy re-striking. For general welding work on light-gage sheet steel.

\- - 3 4 - - - - - -

RED ANCHOR—Anchor Drawn Steel Co., Latrobe, Pa. Carbon .95-1.1; commercial carbon drill rods; for precision shafts for motors, spindles, anvils and dental tools.

\- - - 4 5 - - - - -

REPUBLIC—Alloy Steel Div., Republic Steel Corp., Massillon, O. These alloy steels meet demands for material of lighter weight, greater strength, resistance to shock, impact and torsional strain, and high fatigue resistance; for severe service.

\- - - 4 - - - - - -

REPUBLIC DOUBLE STRENGTH—Republic Steel Corp., Alloy Steel Div., Massillon, O. A low-alloy, copper-nickel-molybdenum steel with high tensile strength, excellent workability and resistance to atmospheric corrosion. Manganese .5-1, phosphorus .04 max., sulphur .04 max., copper .5-1.5, nickel .5-1.25, molybdenum .1 min., carbon in two ranges—Grade No. 1, .12 max., Grade No. 1-A, .3 max. Available in hot-rolled and cold-rolled sheets, hot-rolled angles and formed sections; easily weldable; abrasion resistant. Used for lightweight construction.

1 - - - 5 - - - 9 -

REVALON—Revere Copper & Brass Inc., New York. Copper 76, aluminum 2.25, arsenic .04, balance zinc; in tubing and plates. In fabrication, material can be brazed, soldered or welded. Resists corrosion caused by high velocity, salt or brackish waters. Abrasion resistance, medium; tensile strength, ult., 55-80,000 lb. per sq. in.; ductility, high; specific gravity, 8.31; bearing properties fair; used for condenser tubes for utility, oil refinery, marine, heat exchangers, etc.

1 2 - - 5 - - - - -

REVERE CUPRO-NICKEL (30 per cent)—Revere Copper & Brass Inc., New York. Copper 70, nickel 30; furnished as finished rods or bars, tubing, sheets, strips (coiled) and plates; for fabricating into parts by stamping, extruding, welding, deep drawing or cold forging. Resists heat to 500 degrees Fahr.; abrasion resistance, medium; tensile strength, ult., 50-90,000 lb. per sq. in.; ductility, high; specific gravity, 8.95; annealing range 1200-1600 degrees Fahr.; brinell hardness, hard, 140, soft, 70. Used for marine condenser tubes and condenser plate, cold-headed bolts and parts, etc.

1 - 3 4 - - - - - -

REX Z METAL—Chain Belt Co., Milwaukee. Furnished as castings; resists corrosion caused by weather and inorganic acids to a degree; resists heat to 1100 degrees Fahr.; high abrasion resistance; tensile strength, ult., 80,000 lb. per sq. in.; medium ductility; specific gravity, 7.45; good bearing properties; brinell hardness, untreated 200; for cast parts requiring high strength and good machinability.

1 2 - - - 6 - - - -

REZISTAL—Crucible Steel Co. of America, New York. Stainless steels available in the following grades:

301; carbon over .08-.2, chrome 16-18, nickel 6-8, manganese 2 max.

KA2, type 302; carbon over .08-.2, chrome 17-19; nickel 8-10, manganese 2 max.

2-C, type 302B; carbon over .08-.2, chrome 17-19, nickel 8-10, silicon 2-3, manganese 2 max.

FM-188, type 303; carbon .2 max., chrome 17-19, nickel 8-10, sulphur or selenium .07 min., molybdenum .60 max., manganese 2 max.

KA2S, type 304; carbon .08 max., chrome 18-20, nickel 8-10, manganese 2 max.

KA2S-2010, type 308; carbon .08 max., chrome 19-22, nickel 10-12, manganese 2 max.

No. 3, type 309; carbon .2 max., chrome 22-24, nickel 12-15, manganese 2 max.

No. 3S, type 309S; carbon .08 max., chrome 22-24, nickel 12-15, manganese 2 max.

No. 7, type 310; carbon .25 max., chrome 24-26, nickel 19-22, manganese 2 max.

No. 4, type 311; carbon .25 max., chrome 18-20, nickel 24-26, manganese 2 max.

KA2SMO, type 316; carbon .1 max., chrome 16-18, nickel 10-14, molybdenum 2-3, manganese 2 max.

KA2SMO, type 317; carbon .1 max., chrome 17.5-20, nickel 10-14, molybdenum 3-4, manganese 2 max.

KA2ST, type 321; carbon .1 max., chrome 17-19, nickel 8-12, titanium min. 4 × C, manganese 2 max.

2600, type 325; carbon .5 max., chrome 7-10, nickel 19.5-23.5, copper 1-1.5.

329; carbon .2 max., chrome 23-28, nickel 2.5-5, molybdenum 1-2.

330; carbon .25 max., chrome 14-16, nickel 33-36.

KA2SCB, type 347; carbon .1 max., chrome 17-19, nickel 8-12, columbium 8 × carbon min., manganese 2 max.

Turbine, type 403; carbon .15 max., chrome 11.5-13.

405; carbon .08 max., chrome 11.5-13.5, aluminum .1-.3.

406; carbon .15 max., chrome 12-14, aluminum 3.5-4.5.

No. 12, type 410; carbon .15 max., chrome 10-14.

No. 122, type 414; carbon .15 max., chrome 10-14, nickel 2.5 max.

FM2, type 416; carbon .15 max., chrome 12-14, sulphur or selenium .07 min., molybdenum .6 max.

Gr. A, type 420; carbon over .15, chrome 12-14.

420F; carbon over .15, chrome 12-14, sulphur or selenium .07 min., molybdenum .6 max.

No. 17, type 430; carbon .12 max., chrome 14-18.

430F; carbon .12 max., chrome 14-18, sulphur or selenium .07 min., molybdenum .6 max.

No. 162, type 431; carbon .2 max., chrome 14-18, nickel 2.5 max.

Gr. B, type 440; carbon over .12, chrome 14-18.

441; carbon over .2, chrome 14-18, nickel 2.5 max.

No. 20, type 442; carbon .35 max., chrome 18-23.

No. 27, type 446; carbon .35 max., chrome 23-30.

\- - 3 4 5 - - - - -

ROL-MAN—Manganese Steel Forge Co., Philadelphia. Furnished in rods or bars, wire, sheets and plates, also hot forgings, stampings, wire cloth, welded and ground parts; contains manganese 11-14; carbon 1.1-1.4; resists heat to 400 degrees Fahr.; has high abrasion resistance; tensile strength, 140-160,000 lb. per sq. in.; compressive strength 100,000; high ductility; nonmagnetic; brinell hardness, heat treated 190-210; brinell work-hardened, 325-500; used where abrasion resistance and high strength are needed; also for electrical uses.

1 - - 4 5 - - - - -

ROMAN BRONZE—Revere Copper & Brass Inc., New York. Copper 60, tin .75, zinc 39.25; for forging, flanging, upsetting; uses include piston rods, shafting, bearing applications, etc.

1 2 3 4 - - - - - -

RUSTLESS—Rustless Iron & Steel Corp., Baltimore.

1 2 3 - - - - - - -

13-HC-35, type 420; carbon .4 max., chromium 12-14; hardening type of stainless steel; brinell hardness 550; used for valve parts, knife blades, abrasion and corrosion-resisting machine parts.

17-HC-60 and 90, type 440; carbon .6-1.1, chromium 14-18; hardening type of stainless steel; brinell hardness 625; used for same type of machine parts as type 420.

1 2 - 4 - - - - - -

25-12, type 309; carbon .2 max., chromium 22-26; nickel 12-14; highly resistant to heat and creep to 1300 degrees Fahr., scaling to 2000 degrees Fahr.; resists nitric-sulphuric acid mixtures and sulphite liquors; used for furnace parts and for parts where corrosion conditions are severe.

1 2 3 4 - - - - - -

RUSTLESS 17—Rustless Iron & Steel Corp., Baltimore.

1 2 - 4 - - - - - -

Type 430; carbon .12 max. and chromium 14-18; resists sulphur gases, nitric, and organic acids; nonhardenable; for corrosion-resisting rivets, screws, bolts and other parts.

\- 2 3 - - - - - - -

Type 430F; carbon .12 max., sulphur .15 min. and chromium 14-18; free-cutting stainless steel which resists heat to 1450 degrees Fahr.; tensile strength 100,000 lb. per sq. in.

S

1 2 - - - 6 - - - -

SABECO—Saginaw Bearing Co., Saginaw, Mich. No. 5 bearing bronze; copper 69-71, tin 4.5-5.5, lead 24-26, max., impurities .2; for light or medium load and water lubricated bearings.

No. 9; copper 69-71, tin 8.5-9.5, lead 20-22, max., impurities .2; for heavy loads such as average machine tool requirements.

No. 11; copper 69-71, tin 10.5-11.5, lead 18-20, max. impurities .2; for extra heavy unit pressures.

No. 11HG; copper 69-71, tin 10.5-11.5, lead 18-20, max. impurities .2; for worm wheels, clutch shifter shoes, forging machine slides, and extreme heavy bearing conditions.

No. 16; copper 69-71, tin 15-16.5, lead 13.5-14.5, max. impurities .2; for friction rings, and heavy-duty boring spindle bearings.

See advertisement, Page 82

1 - 3 4 - - - - - -

SANDUSKY ALLOY IRON—Sandusky Foundry & Machine Co., Sandusky, O. Nickel, chrome and molybdenum cast iron alloys; furnished in tubing, centrifugally cast and in finished cylindrical parts; resists corrosion; high abrasion resistance; tensile strength 25-60,000 lb. per sq. in.; brinell hardness, untreated, 160-300; heat treated, 300-600; used for rolls, liners, sleeves, bushings, cylinders, pipes and tubes.

1 - - 4 - 6 - - - -

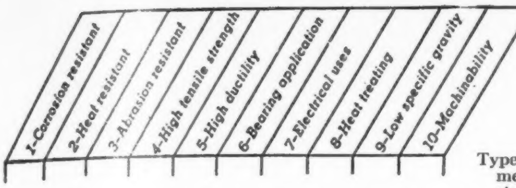
SANDUSKY BRONZES—Sandusky Foundry & Machine Co., Sandusky, O. Bronze, brass and manganese bronze alloys; furnished in tubing, centrifugally cast and in finished cylindrical products; resists corrosion due to composition and superior structure; tensile strength 30-110,000 lb. per sq. in.; good bearing properties; brinell hardness, untreated, 40-250; used for rolls, liners, sleeves, bushings, cylinders, pipe, tubes of 3-46 inches in diameter and up to 330 inches in length.

\- - - - - 6 - - - 10

SATCO Bearing Metal—Magnus Metal Corp., Chicago. Lead-base alloy containing from 94-98 per cent lead, with balance tin, calcium and other auxiliary hardeners; melting point about 125 degrees higher than that of tin-base and lead-base babbitt metals, with higher resistance to deformation and wiping at elevated temperatures. Material is furnished in ingot form and also lined bearings. Mechanical properties in untreated state: ult. tensile strength, 11-13,000 lb. per sq. in.; compressive, 15-17,000; elongation, 8-12 per cent; hardness, 22-24 brinell; recommended as a lining for brass, bronze and steel back bearings.

1 - - - - 6 7 - - -

SCOVILL—Scovill Mfg. Co., Waterbury, Conn. A complete line of high and low brasses, phosphor-bronzes, nickel-silvers, and cupro-



nickels for various mechanical, electrical and heat-exchanger purposes.

1 - - 4 5 - - - - - -
SCOVILL Phosphorized Admiralty Tubes—Scovill Mfg. Co., Waterbury, Conn. Copper 70, tin 1, phosphorus .03, zinc balance; in tubing; resists dezincification; resists corrosion caused by alkalis, weak acids, sulphur, petroleum compounds; resists heat to 500 degrees Fahr.; abrasion resistance, high; tensile strength, ult., (soft) 50,000 lb. per sq. in.; ductility, high; for condenser tubing, particularly where dezincification is to be expected.

1 - - - - - - - - - 10
SCOVILL FREE-CUTTING BRASS ROD—Scovill Mfg. Co., Waterbury, Conn. Copper 61, lead 3, zinc 36; in finished rods or bars, for hot forging, turning, boring, etc. Resists heat to 500 degrees Fahr.; abrasion resistance, medium; tensile strength, ult., 55-75,-000 lb. per sq. in.; ductility, medium; specific gravity, 8.5; bearing properties, fair. Specially adapted to fabricating on high-speed screw machines.

1 - - - - 6 - - - 10
SCOVILL HARDWARE BRONZE—Scovill Mfg. Co., Waterbury, Conn. Copper 89, lead 2, nickel 1, balance zinc; furnished in rods, bars and wire for turning, boring, etc.; machinability good; resists corrosion caused by atmospheric conditions; tensile strength, 38-85,000 lb. per sq. in.; specific gravity, 8.85, bearing properties good; recommended heat treatment, annealing, 1000-1100 deg. Fahr.; brinell hardness, untreated, 48-125; used for screw machine products.

1 - - - - - - - - -
SCOVILL NAVAL BRASS—Scovill Mfg. Co., Waterbury, Conn. Copper 60, tin .75, zinc 39.25; in finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc. Resists heat to 500 degrees Fahr.; medium abrasion resistance; tensile strength, ult., 60-90.000 lb. per sq. in.; ductility, medium; weldability, fair; specific gravity, 8.4, used for boat shafting, turn buckles, welding rod, etc.

- - - - - 6 7 - - -
SELFLUBE—Keystone Carbon Co., Saint Marys, Pa. Self-lubricating porous bronze and porous iron, furnished in plates, bearings, sleeves, spherical, etc.; yield point for bronze, 12,-090 per sq. in.; 30,000 lb. per sq. in. min., 50.000 lb. per sq. in. max., for iron, ductility, high; for bearings, bushings, etc.

See advertisement, Page 195

- - 3 4 - - - 8 - -
SEMINOLE—Allegheny Ludlum Steel Corp., Pittsburgh. Carbon .45, chromium 1.3, tungsten 2, vanadium .25; for high-creep strength bolts and studs for superheated steam; also machine parts having high wear and fatigue values. Withstands moderately elevated temperatures. May be oil hardened.

See advertisement, Page 99

1 2 - - - - - - - -
SHARON—Sharon Steel Corp., Sharon, Penna. Stainless and heat-resisting alloy. Chrome-nickel group 17-7. chromium 17, nickel 7, carbon .09-.20. Used for automotive trim, for deep drawing where straight-chromium types are not sufficiently ductile.

18-8; chromium 18, nickel 8, carbon .08-.20; specially suited to resist atmospheric erosion and corrosion; for dairy and chemical plant equipment, food, meat, processing machinery, high strength, lightweight structural members and for resisting the oxidation of elevated temperatures.

Alloy steel, hot and cold-rolled strip steel, hot and cold-rolled sheet steel, Galvanite, galvanized, tin, terne and zinc coated strip and sheet, also available.

- - - 4 - - - - - -
SHENANGO-PENN—Shenango-Penn Mold Co., Dover, O. Centrifugal castings in all bronzes, Monel metals and alloy irons; used for bearings, bushings, drums, liners, roll covers, sleeves, washers, rings, etc.

See advertisement, Page 183

- - - 4 - - - - - -
SHIELD-ARC—Lincoln Electric Co., Cleveland.

Type 85; high-tensile welding rod; recommended for fabrication of high-tensile steels; brinell 190-250.

Type 100; brinell hardness 235-300.

1 - - 4 5 - - - - -
SHOCK PROOF—Lake City Malleable Co., Cleveland. Malleable iron of high tensile strength, high yield point and ability to withstand shock and abuse, possessing good machining qualities and resistance to corrosion; ult. tensile strength, 53,000 lb. per sq. in.; heat resistant up to 1900 degrees Fahr. and high abrasion resistance.

See advertisement, Page 202

1 2 - - - - - 8 - -
SICROMO—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.

1 2 - - - - - - - -
Type 1; carbon .15 max., manganese .5 max., phosphorus .03 max., sulphur .03 max., silicon 1-1.4, chromium .75-1.25, molybdenum .45-.65; furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc. Material is corrosion-resistant; heat-resistant to 1050 degrees Fahr.; tensile strength, ult., 60,000 lb. per sq. in., min.; fair weldability; and brinell hardness, annealed 163 max. For use in oil refinery field.

1 2 - - - - - 8 - -
Type 2; similar to above with slightly higher chromium content.

1 2 - - - - - - - -
Type 2½; similar to Type 2 with slightly lower silicon content.

Type 3; similar to Type 2½, with slightly higher silicon and chromium content.

1 2 - - - - - 8 - -
Type 5; similar to Type 3, with lower silicon content and higher chromium.

Type 5S; similar to Type 5, differing only in higher silicon content.

1 2 - - - - - - - -
Type 7; similar to Type 5S, having lower silicon and higher chromium content.

1 2 - - - - - 8 - -
Type 9; similar to Type 7, having higher chromium content. All above materials are for oil refinery use.

Type 7M; similar to Type 7, but having an increased molybdenum content.

Type 9M; similar to Type 9, but having an increased molybdenum content.

1 - - 4 5 - - - - -
SIL-FOS—Handy & Harman, New York. Brazing alloy containing silver 15, copper 80, phosphorus 5; flows at 1300 degrees Fahr. furnished in rods, wire, sheets and strips (coiled); corrosion-resistant; high ductility; specific gravity 8.45; used to join nonferrous metals only, particularly copper, brass and bronze.

1 - 3 - - - - - - -
SILFRAM—Stoody Co., Whittier, Calif. a hardfacing metal designed for application to parts subjected to corrosion, abrasion and impact.

1 2 - - - - - - - -
SILMO—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon .15 max., manganese .5 max., phosphorus .04 max., sulphur .045 max., silicon 1.15-1.65, and molybdenum .45-.65; furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc., into parts. Tensile strength, ult., 55,000 lb. per sq. in. min.; resists heat to 1000 degrees Fahr.; fair weldability; brinell hardness, annealed 163 max. For use in oil refinery field.

1 - 3 - 5 - - - - -
SILVER-PLY—Jessop Steel Co., Washington, Pa. Stainless-clad steel in any desired analysis and all degrees of cladding from 3-50 per cent; furnished as sheets or plates for stamping and welding into parts; corrosion resistant; high abrasion resistance; tensile strength, average, 63,000 lb. per sq. in.; high ductility and good weldability; used for heads, tank wells, lids and any part in which corrosion resistance is important.

- - - - - - - - - 10
SOFTWELD—Lincoln Electric Co., Cleveland. For arc welding cast iron where easy machinability is required.

1 - - 4 - - - - - -
STA-GLOSS—Jessop Steel Co., Washington, Pa., A, type 420; stainless steel; ult. strength, 230,000 lb. per sq. in.; yield point, 220,000 lb. per sq. in.; elongation in 2 inches, 2½; brinell hardness, 500; used for gears, pump rods, etc.

B, type 440; stainless steel; ult. strength, 280,000 lb. per sq. in.; yield point 250,000 lb. per sq. in.; brinell hardness, 580; used for engine parts, gages, etc.

C, type 440; stainless steel; ult. strength. 310,-000 lb. per sq. in.; yield point, 270,000 lb. per sq. in.; brinell hardness, 600; used for valve seats, bearings, etc.

- - - 4 - - - - - -
STAINWELD—Lincoln Electric Co., Cleveland. Coated electrode for welding stainless steels or building up surfaces to resist corrosion.

Type A-5; for large number of so-called 18-8 stainless steels. Welds are of high tensile strength and ductility and possess same resistant qualities as the parent metal. Contains suitable amount of columbium to prevent intergranular corrosion of deposited metal.

Type A-7; for stainless steels of 18 per cent chromium, 8 per cent nickel type; fast-flowing, smooth operating; especially adapted for surfacing other steels with minimum admixture of base metal.

Type B; for arc welding stainless steel with chemical content of approximately 25 per cent chromium and 12 per cent nickel. Physical properties equal to metal welded.

Type C; a modification of the well-known 18-8 analysis, commonly known as 18-8 SMO (approx. 3½ molybdenum). Suitable for welding stainless steels of types 316-317 (Iron and Steel institute).

Type D; for stainless steels of 25 per cent chromium, 20 per cent nickel types; also for welding stainless steels to mild steel and for welding steels which are air-hardened and cannot be heat treated after welding.

- - - - - 6 - - - -
STANNUM BABBITT—Lumen Bearing Co., Buffalo. Tin base bearing babbitt.

1 2 3 - - - - - - -
STELLITE—Haynes Stellite Co., Kokomo, Ind. Metal-cutting tools for nonferrous cobalt-chromium-tungsten alloy, as solid square and rectangular bits, welded-tip tools and special tools.

1 - 3 4 5 - - - - -
STERLING Stainless Steels—Firth-Sterling Steel Co., McKeesport, Pa.

1 - 3 4 - - - - - -
Type A (420); carbon .35, chromium 13.5; corrosion-resistant; tensile strength 240,000 lb. per sq. in.; for ball bearings and automotive parts subject to wear. Good physical properties in heat-treated state; maximum resistance to corrosion secured by hardening and through grinding.

1 - - 4 - - - - - -
Type T (410); carbon .10, chromium 13; possesses maximum strength and elasticity without sacrifice of toughness; machinable and corrosion-resistant; for pump rods, shafts, valve parts, gun barrels, pistons and machinery parts where strength is of greater importance than ease of machining.

1 - - 4 - - - - - -
Type TX (403); modified Type T used for turbine blading.

1 - - 4 5 - - - - -
Type FC (416); free-cutting stainless steel wherein a slight sacrifice in physical properties and corrosion resistance is made to obtain easier machining; for machine parts including screws, bolts, nuts, pump shafts, valves and spindles.

Type M (430); soft ductile steel that does not work-harden readily; requires no heat treatment to secure corrosion resistance.
Type BHH (440); for bearings; extremely hard and resistant to abrasion.

1 - - 4 5 - - - - -
STERLING-NIROSTA Stainless Steels—Firth-Sterling Steel Co., McKeesport, Pa.

1-Corrosion resistant | 2-Heat resistant | 3-Abrasion resistant | 4-High tensile strength | 5-High ductility | 6-Bearing application | 7-Electrical uses | 8-Heat treating | 9-Low specific gravity | 10-Machinability

Types KA2, KA2-FC, KA2S and 19-9; of the 18-8 chrome-nickel group containing approximately 18 per cent chromium and 8 per cent nickel with various modifications or additions to give special physical properties, machinability or resistance to certain corrosive action; the free-cutting type can be easily machined, and cold work-hardened wire and strip have great strength and resiliency.

Type FC (303); free-machining 18-8 steel.

\- - 3 - - - - - - -

STOODITE—Stoody Co., Whittier, Calif. A hard-facing metal used chiefly as overlay on earth working equipment.

\- - 3 - - - - - - -

STOODITE "K" (Self-hardening)—Stoody Co., Whittier, Calif. Molybdenum-manganese-silicon-tungsten welding rod; hardness number, 55-60 Rockwell C; excellent weldability characteristics; for hard-facing wearing parts.

\- 2 3 - - - - - - -

STOODITE (Numbered)—Stoody Co., Whittier, Calif.; include Stoodite "45," "54" and "63," which range in physical properties from extreme hardness to extreme toughness. Rockwell "C" hardness indicated by numbers; designed for applications involving heat, impact or abrasion.

\- - 3 - - - - - - -

STOODY (Self-Hardening)—Stoody Co., Whittier, Calif. A hard-facing metal used chiefly as an overlay on earth working equipment.

\- - - 4 - - - - - 10

STRAINFREE ELASTUF PENN (Cold-finished)—Horace T. Potts Co., Philadelphia. Steel of manganese type without chromium, furnished in finished rods or bars; tensile strength 140,000 lb. per sq. in.; medium ductility; nondistorting; high physicals; cold finished; brinell hardness, untreated 269. Used for parts whose length exceeds cross-sectional dimension as gears and worms with integral shafts.

\- - 3 4 - - - - - -

STRESSPROOF—La Salle Steel Co., Hammond, Ind. A modified SAE X1340 steel in finished bars for machining; yield point 100,000 lb. per sq. in.; and 90 000 lb. per sq. in. depending upon the size; used for worm gears, lead screws, spindles, shafts and speed reducers.

\- - - - - 6 - - - -

SUMET—Sumet Corp., Buffalo. High-leaded bronzes as follows:

SM-4; lead 28 per cent; for high-speed and light-duty service.

SM-8; lead 26 per cent; for moderate speed and general service; suitable for machine tool bearings.

SM-10; lead 24 per cent; for general applications such as aeronautical engines, clutch cones and disks, compressors, connecting rods, crank pins, etc.

SM 12; lead 22 per cent; for cone and gyratory crushers, crane and ore machinery, mining machinery, etc.

SM 16; lead 20, for heavy-duty service such as crane motor compressor, dredging machinery, etc.

SM 18; lead 17.5 per cent; for cross-head pins, cranes, railroad, steam shovel, etc.

SM 14; lead 14 per cent; for thrust bearings, gears, etc.

SM 22; lead 10 per cent; for special steel mill applications.

See advertisement, Page 122

1 - - 4 - - - 8 - -

SUMMERILL—Summerill Tubing Co., Bridgeport, Pa. Seamless tubing in practically all regularly used carbon grades from SAE 1010 to SAE 1095. Others are chrome molybdenum SAE 4130X, 4140, 4150, 4185, 52,100, 4340; nickel silver, pure nickel silver, corrosion resistant steels—18-8, 16-13-3 and similar grades; 4 to 6 per cent chrome with ½ moly; also some of 12-14 per cent chrome. Used for mechanical specialties, aircraft, industrial control instruments, fuel injection tubing for diesel engines, etc.

1 - - - - - 6 7 - - -

SUPERIOR Copper Steel—Superior Metal Co., Chicago. Corrosion-resistant steel electro-copper-plated; in sheets and coiled strips for stamping and welding; resists corrosion caused by moisture; resists heat up to 1400 in controlled oxidation; abrasion resistance, medium; weldability, fair; used to substitute for solid copper sheet and strip.

1 2 3 4 5 - - 8 - -

SUPERIOR Stainless Steel—Superior Steel Corp., Carnegie, Pa. Hot and cold-rolled strip steel and stainless steels in all grades and analyses.

1 2 - - 5 - - - - -

301; chromium 16-18, nickel 7-9, carbon .09-.2; in strips for stamping and welding; ult. tensile strength (heat treated), 95-100,000 lb. per sq. in.; impact resistance, high; nonmagnetic; weldability, good; used for trim-wearing plates, parts where strength is needed, airplane parts, etc.

302; chromium 17.5-20, nickel 8-10, carbon over .08-.2; in coiled strips for stamping and welding; in heat-treated state, ult. tensile strength, 90-95,000 lb. per sq. in.; yield point, 30-40,000 lb. per sq. in.; elongation 55-65 per cent; impact resistance, high; for use same as type 301.

321 and 347 titanium and columbium stabilized stainless steels are also available.

1 - - 4 - - - 8 - -

410; chromium 10-14, carbon .15 max., manganese .3-.5, silicon .3-.5, phosphor and sulphur .03 max.; in coiled strips for stamping and welding; ult. tensile strength, 60-75,-000 lb. per sq. in.; yield point 35-45,000 lb. per sq. in.; abrasion resistance, high; for wearing plates, brackets, etc.

1 2 3 - - - - - - -

430; chromium 14-18, carbon .12 max., manganese .25-.5, silicon .3-.5, phosphor and sulphur .03; in strips for stamping and welding; ult. tensile strength, 70-80,000 lb. per sq. in.; yield point 45-55,000 lb. per sq. in.; heat resistant to 1500 degrees Fahr.; abrasion resistance, high; for wearing plates, bright parts trim, etc.

1 - - - - - - 8 - -

SAE X4130; carbon .27-.33, manganese .4-.6, phosphorus .04-.05 max., chromium .8-1.1, and molybdenum .15-.25; in coiled strips for stamping and welding; ult. tensile strength, 90,000 lb. per sq. in.; yield point, 70,000 lb. per sq. in., min.; elongation in 2 inches, 10-20 per cent; weldability good; for highly stressed or critical parts as aircraft work.

Also materials fulfilling requirements of government specifications AN, QQ-S-772, AN, QQ-S-757 and U. S. Navy 47-S-20. Hot and cold rolled strip steel, high carbon, low carbon alloys, including X4130 and Nitralloy.

1 - 3 - - - - - - -

SUPERMAL—The Jeffrey Mfg. Co., Columbus, O. High-strength malleable iron; resists heat to 400 degrees Fahr.; high abrasion resistance; tensile strength 70,000 lb. per sq in.; medium ductility; brinell hardness. heat-treated, 180-200; used for cast chains for drives and conveyor service.

1 - - - - - - - - -

SUPERSTRIP—Acme Steel Co., Chicago. Hot-rolled strip steel; furnished in sheets and strips (coiled) for stamping into parts. Material is furnished to specifications and is available in most sizes from ¼ to 22 inches in width and in thickness from ¼-inch and less.

\- 2 - 4 - - - - - -

SUPERTEMP—Bethlehem Steel Co., Bethlehem, Pa. A patented alloy steel having high strength at high temperatures; suitable for bolts and studs for reaction chambers, cracking stills, superheaters, etc.

1 - - - - - - - - -

SURFACEWELD—Lincoln Electric Co., Cleveland. A fine-grained alloyed powder for application with the carbon arc. Gives smooth abrasion resisting surface. Can be applied in thin layer. Properly applied, coating will have a hardness of 54 Rockwell C. Maintains hardness and resists scaling at high temperatures. Corrosion resistance comparable to stainless steel.

T

1 - - 4 - - - - - 10

T-1 ALUMINUM—The National Bronze & Aluminum Foundry Co., Cleveland. Copper 1.5-2.25, tin 1.25-1.75, magnesium .5-1, zinc .5-1.25, chromium .1-.3, balance aluminum; furnished as finished castings or ingots for sand casting; corrosion resistant; good physical properties at elevated temperatures; high abrasion resistance; tensile strength 30,000 lb. per sq. in., min.; high ductility; good bearing properties; for use in parts where light weight and high strength are needed.

See advertisement, Page 83

\- - 3 - - - - - - -

TALIDE—Metal Carbides Corp., Youngstown, O. Tungsten carbide metal; resists corrosion due to high tungsten content; heat resistant to 2000 degrees Fahr.; high abrasion resistance; tensile strength 300,000 lb. per sq. in.; specific gravity 14.1; brinell hardness, untreated, 130 and over; for use as wear plates and guides, cutting tools, drawing dies and bushings.

1 - - 4 5 - - - - -

TAMCO—Titanium Alloy Mfg. Co., Niagara Falls, N. Y. Alloys including original high and medium carbon ferro carbon-titanium, foundry ferro-titanium, and several varieties of low-carbon ferro-titanium for rolled, cast and forged steels, stainless and alloy steels, and gray cast iron. For the nonferrous field, alloys include TAM Webbite (alumino-titanium) for aluminum castings, cupro-titanium for copper, nickel-titanium, molybdenum-titanium, and special alloys for special purposes, in addition to metallic titanium and metallic zirconium.

See advertisement, Page 199

\- 2 3 - - - - - - -

TEMP ALLOY—Continental Roll & Steel Foundry Co., East Chicago, Ind. Chrome alloy heat-resisting cast iron used for furnaces and other designs subject to high temperatures and abrasion.

See advertisement, Page 167

1 - - 4 - - - 8 -

TEMPALOY—American Brass Co., Waterbury, Conn. Copper-aluminum-nickel alloys which yield to heat treatment; abrasion resistant; uses include motor boat shafting, piston rods, bearing application, etc.

See advertisements, Pages 92-93

\- - - 4 5 - - - - -

THOMASTRIP—Thomas Steel Co., Warren, O. Cold-rolled strip steel, bright finish uncoated and electro-coated in brass, bronze, nickel, zinc and tin.

\- - 3 - 5 - - - - -

TIGERLOY—Massillon Steel Casting Co., Massillon, O. Nickel-molybdenum; for shovel castings, gears, crane track wheels, castings for impact resistance, etc.

\- - 3 4 5 - - - - -

TIMANG—Taylor-Wharton Iron & Steel Co., High Bridge, N. J. Nickel-manganese steel; can be rolled, drawn, forged or shaped; for journal box liners, pedestal gib liners, conveyor flights, welding rod, etc.

1 2 - 4 - - - 8 - -

TIMKEN—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.

\- - - 4 - - - 8 - -

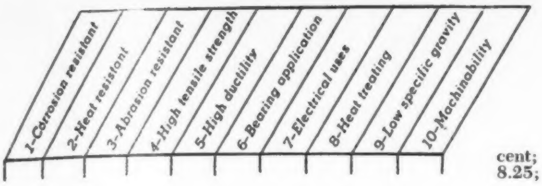
Type 17-22A; carbon .3-.35, manganese .5 max., chromium 1-1.5, molybdenum .45-.65, vanadium .25-.35, in rough bars or billets, and finished rods or bars for hot forging, turning, boring, etc. Heat resistant to 1200 degrees Fahr.; tensile strength, ult., 200,000 lb. per sq. in., min., heat treated; medium ductility; and brinell hardness, untreated 200, heat treated 470 max. Used for bolts, studs and other highly stressed parts at elevated temperatures.

1 2 - - - - - - - -

Type 18-8; carbon .07 max., manganese .2-.7, silicon .75 max., chromium 17-20, nickel 8-10. This austenitic nonmagnetic alloy shows very good combination of creep and rupture strength, oil corrosion resistance, and oxidation resistance for service up to 1500 degrees Fahr.

1 2 - - - - - - - -

Type 16-13-3; carbon .13 max., manganese 1.5 max., chromium 15.5-17, nickel 12.5-14.5, molybdenum 2.5-3.25. This molybdenum modification possesses higher creep and rupture strength than the standard 18-8 analysis and is also more resistant to certain



types of corrosion, especially those associated with pitting.

Type 4-6 Cr.Mo.; carbon .15 max., manganese .5 max., silicon .5 max., chromium 4-6, molybdenum .45-.65. For service up to 1200 degrees Fahr. where corrosion resistance to hot petroleum products is a primary requirement. Inferior in its oxidation and corrosion resistance to Sicromo 5S.

\- 2 - - - - - - - -

Type .5 Mo. Steel; carbon .1-.2, manganese .3-.6, silicon .5 max., molybdenum .45-.65. For temperatures up to 1000 degrees Fahr. the satisfactory creep strength allows for greater safety than can be obtained from carbon steel. The oxidation and corrosion resistance, however, is similar to that of carbon steels.

1 - 3 4 5 - - - - -

TISCO—Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

1 - - - - - - - - -

Stainless steel castings of all compositions, including chrome-molybdenum, nickel-chrome-molybdenum, 18-8 chrome-nickel, and high chromium.

\- - 3 4 5 - - - - -

Manganese steel castings for shock and abrasion resistance. Used primarily for rock crushers, ball mill liners, sprockets, etc.

Carbon steel castings. Also Alnico and related magnet alloys.

1 - - 4 5 - - - - -

TOBIN BRONZE—American Brass Co., Waterbury, Conn. Copper 60, zinc 39.25, tin .75; abrasion-resistant; uses include piston rods, boat shafting, condenser head plates, welding rods, seamless tubes, etc.

See advertisements, Page 92-93

1 - 3 4 5 - - 8 - -

TOLEDO ALLOY—Unitcast Corp., Steel Casting Div., Toledo, O.

\- - 3 - - - - 8 - -

No. 3; carburizing steel, heat-treated to give good machinability and uniform grain; excellent results obtained with short cycle carburizing treatment.

No. 4; abrasion-resistant silicon-molybdenum steel with good hardening properties; used for mining tools, wear plates, crusher plates and pinions.

\- - 3 - - - - - - -

No. 6 air-hardening die steel of uniform machining qualities; long life under severe wear.

\- - - 4 - - - 8 - -

No. 7; triple heat-treated manganese vanadium steel for many applications in the railroad and locomotive industry where extensive and repeated stress is encountered.

\- - 3 - 5 - - 8 - -

No. 131; carbon .22-.28, manganese .7-.8, copper 1-1.2, vanadium .04-.08, silicon .4-.5, furnished in castings; tensile strength 90,-100,000 lb. per sq. in.; high ductility; for use where high strength and ductility are required and when hardness is of lesser importance.

1 - - 4 5 - - - - -

No. 135; carbon .4-.5, manganese .75-.85, chromium .9-1.1, copper 1-1.15, molybdenum .25-.35; furnished as castings; resists corrosion caused by copper; abrasion resistance, medium; tensile strength, ult., 120,000 lb. per sq. in.; ductility, high; weldability, good; brinell hardness, untreated, 217-241, heat treated, 600; for use in parts requiring high strength, guides, etc.

See advertisement, Page 200

\- - - 4 - - - - - -

TOMBASIL—Ajax Metal Co., Philadelphia. Material available in two grades.

A; copper 81.5, silicon 4.8, zinc 13.7; in untreated state mechanical properties are: ult. tensile strength, 65,000 lb. per sq. in.; yield point, 40,000 lb. per sq. in.; elongation, 15.00 per cent; hardness, 140 brinell; specific gravity, 8.25; nonmagnetic; weldability, good.

Navy; analysis in accordance with Navy Dept. Spec. 46B28—copper 90, silicon 5 max., zinc 5; in untreated state, ult. tensile strength, 55,000 lb. per sq. in.; yield point, 20,000 lb. per sq. in.; elongation, 40.00 per cent; hardness, 105 brinell; specific gravity, 8.25; nonmagnetic; weldability, good.

1 - - - 5 - - - - -

TONCAN IRON—Republic Steel Corp., Cleveland. An open-hearth iron alloyed with .4 min. copper and .07 min. molybdenum; resists corrosion caused by atmosphere, water, oils and process materials; tensile strength, 48-58,000 lb. per sq. in. min.; compressive strength 40,000; brinell hardness 90-120; for housing, piping, tubing, etc. Also enameling stock, available in sheet form.

1 2 3 - - - - - - -

TOOLWELD — Lincoln Electric Co., Cleveland.

Type 60; coated arc welding electrode, deposited hardness of 60-65 Rockwell C; hardness retained to 1000 degrees Fahr.; deposit can be heat treated same as high-speed steel; for building hard, tough cutting edges on cold-rolled steel and for other applications requiring super-hardness.

Type 55; for making metal-cutting edges where shock is encountered (for cutting tools, blades and dies) providing an as deposited weld metal hardness without heat treatment of 55-60 Rockwell C. While not quite as hard as Type 60, it is somewhat tougher and more shock resistant. Otherwise, properties are essentially the same as type 60.

1 2 - - - - 7 - - -

TOPHET—Wilbur B. Driver Co., Newark, N. J.

Type A; approximately 80 per cent nickel and 20 chromium; resists heat to 2100 degrees Fahr.; supplied in wire and strip form for electrical heating applications.

Type C; nickel 60, chromium 15, and balance iron; resists heat to 1800 degrees Fahr.; supplied in wire and strip form; for electrical resistance and heating application.

\- - - 4 - - - - - -

TRANSWELD—Lincoln Electric Co., Cleveland. Heavily-coated electrode of shielded arc type for welding of steel in all positions with A.C. current; tensile strength 80,000-85,000 lb. per sq. in.

\- 2 3 4 - - - - - -

TRANTINYL—Youngstown Alloy Castings Corp., Youngstown, O. Furnished as sand castings. High abrasion resistance; medium ductility; high tensile strength; used for tools for tube and bar mills such as guide shoes, plugs, guides, etc.

\- - - - - 6 7 - - 10

TRODALOY—General Electric Co., Schenectady, N. Y. Resistance welding electrode alloys available in two grades.

\- - - - - 6 7 - - 10

No. 1; cobalt 2.6, beryllium .4, and copper 97; has 55 per cent conductivity of copper. Mechanical properties in heat-treated state: ult. tensile strength, 90-120,000 lb. per sq. in.; impact resistance, high; hardness, 220 brinell; for resistance welding electrodes, soldering iron tips, springs, bushings, castings, brake drums, etc. All sales made through following licensees: P. R. Mallory Co., Ampco Metal Co., Wilbur B. Driver Co., Electroloy Co. and Welding Sales & Engineering Co.

\- - - - - - 7 - - -

No. 7; beryllium .1, chromium .4 and copper 99.5; furnished in rough bars or billets, finished rods or bars, wire, strips, plates for hot forging, stamping, extruding, turning, boring and as sand castings. Mechanical properties in heat-treated state: ult. tensile strength 45-70,000 lb. per sq. in.; impact resistance, high; endurance limit (completely reversed bending), 18-25,000 lb. per sq. in.; hardness, 90-140 brinell; nonmagnetic; used for resistance welding electrodes, high conductivity springs and castings, and substitute for P-bronzes.

1 - 3 4 - 6 7 - - 10

TRUALOY—True Alloys Inc., Detroit.

\- - - - - - 7 - - -

Copper; has high conductivity; castings for welding machines and conduction of current.

\- - 3 - - 6 - - - 10

Bearing bronze; low friction and wear, with high compressive strength; resistant to pounding and easy to machine.

\- - - 4 5 - - - - 10

Aluminum; castings possessing high tensile strength, hardness and lightness.

1 - 3 4 - - - - - -

Aluminum bronze; for sand castings having corrosion resistance and tensile strength of 65,000 lb. per sq. in.; recommended for parts subject to strain and wear.

\- - - 4 - - - 8 - -

TRUFLEX Thermostatic Metal—General Plate Div. of Metals & Controls Corp., Attleboro, Mass. Available in sheets or strips in long lengths, flattened and coiled, or cut to length—spiral, helix or double helix coils; corrosion and heat-resistant; high tensile strength; for electrical uses.

U, V

1 2 3 4 5 - 7 8 - -

U. S.—United States Steel Corp., subsidiaries, including Carnegie-Illinois Steel Corp., Columbia Steel Co., National Tube Co., Tennessee Coal Iron & Railroad Co., and American Steel & Wire Co.

1 2 - 4 - - - - - -

Type 302, U. S. S. 18-8; carbon .08-.2, chromium 17-20, nickel 7-10; resists heat to 1650 degrees Fahr., high abrasion resistance; atmospheric and acid resistant; tensile strength ult., 80-95,000 lb. per sq. in. annealed. 105-300,000 lb. per sq. in. cold worked; high ductility; weldability, good; brinell hardness, annealed, 135-185; for food processing and chemical equipment, etc., fabricated by other than welding.

1 2 - - 5 - - - - -

Type 303, U. S. S. 18-8 F. M.; carbon .2, manganese 1.5, sulphur or selenium .07 min., molybdenum .6, silicon .75, chromium 17.5-20, nickel 8-10; resists heat to 1600 degrees Fahr.; high abrasion resistance; tensile strength, ult., 80-95,000 lb. per sq. in.; high ductility; brinell hardness, untreated, 135-220; for nuts, bolts, valve parts, and shafting.

1 2 - 4 - - - - - -

Type 304, U. S. S. 18-8-S; carbon .08 max., chromium 18-20, and nickel 8-10; similar to Type 302; abrasion-resistant; high ductility; used where corrosion resistance is desired after fabrication by welding.

1 2 3 - - - - - - -

Type 309, U. S. S. 25-12; carbon .2, manganese 2, phosphorus .03, silicon .75, chromium 22-26, nickel 12-14. Corrosion and heat-resistant; high abrasion resistance; tensile strength, ult., 90-110,000 lb. per sq. in.; high ductility; brinell hardness, untreated, 150-185; for high temperature service, 2100 degrees Fahr. max.

1 - - - 5 - - - - -

Type 316, U. S. S. 18-8 Mo.; carbon .1; manganese 2, phosphorus .03, silicon .75, chromium 16-18, nickel 10-14 max., molybdenum 2 to 3. Corrosion and heat-resistant; high abrasion resistance, tensile strength, ult., 80-95,000 lb. per sq. in.; high ductility for chemical and food equipment.

1 2 - 4 - - - - - -

Type 321, U. S. S. 18-8-Ti.; carbon .1 max., chromium 17-20, nickel 7-10, silicon .75, manganese 2, phosphorus .03, titanium four times actual carbon minimum; addition of titanium prevents susceptibility to intergranular corrosion. Tensile strength, 80-95,000 lb. per sq. in.; high ductility; abrasion-resistant; high temperature service and where welded parts are subject to corrosion.

1 2 - - 5 - - - - -

Type 347, U. S. S. 18-8 Cb.; carbon .1, chromium 17-20, nickel 8-12, manganese 2, phosphorus .03, silicon .75, columbium 10 times carbon min.; addition of columbium prevents susceptibility to intergranular corrosion; tensile strength, ult., 80-95,000 lb. per sq. in.; high abrasion resistance; for high temperature service and where welded parts are subject to corrosion.

1 - 3 - - - - 8 - -

Type 410, U. S. S. 12; carbon .15, manganese .75, phosphorus .03, sulphur .03, silicon .75 max., chromium 10-14, corrosion and oxidation resistant; responds to heat treatment and can be modified by addition of columbium, aluminum and molybdenum for specific application; tensile strength, ult., 65-85,000 lb. per sq. in. annealed, 100-200,000 lb. per sq. in. heat-treated; high ductility; high abrasion resistance; for turbine blading, shafting, valve parts, wire

1-Corrosion resistant
2-Heat resistant
3-Abrasion resistant
4-High tensile strength
5-High ductility
6-Bearing application
7-Electrical uses
8-Heat treating
9-Low specific gravity
10-Machinability

cable, screens, nuts and bolts.

1 - 3 - 5 - - - - -
Type 416, U.S.S.-12 F.M.; carbon .15, manganese 1.25, phosphorus .04, sulphur or selenium .07 or molybdenum .6, silicon .75 max., chromium 12-14; similar to Type 410 except addition of sulphur, selenium or molybdenum increases the machinability; not to be used where welding is required; used for shafting, nuts, bolts, valve, trim and valve parts.

1 2 - - 5 - - - - -
Type 430, U.S.S.-17; carbon .12 max., manganese .75, phosphorus .03, sulphur .03, silicon .75, chromium 14-18, nickel .5; resists corrosion caused by nitric acid, atmosphere and industrial corrosives; resists heat to 1550 degrees Fahr.; medium abrasion resistance; tensile strength, ult., 70-90,000 lb. per sq. in.; used in nitric acid equipment, as screens, valves, shafting, nuts, bolts, rivets and plate construction.

1 2 - - - - - - - -
Type 446, U.S.S.-27; carbon .35, manganese 1, phosphorus .035, sulphur .035, silicon 1.5, chromium 23-30, nickel 1; resists heat to 2100 degrees Fahr.; medium abrasion resistance; tensile strength, ult., 75-95,000 lb. per sq. in.; for high temperature service, where resistance to sulphides and concentrated nitric acid is required.

Type 501, U.S.S.-5; carbon over .1 and chromium 4-6.

Type 502, U.S.S.-5-S; carbon .1 max., chromium 4-6; molybdenum .5 is added to increase creep strength and avoid temper brittleness; columbium is added to eliminate air hardening and increase oxidation resistance slightly.

1 2 - - - - - - - -
Shelby 5 per cent chrome-molybdenum tubing; used for furnace tubes in oil-cracking stills, condensers and superheaters where high temperatures and pressures, and corrosive fluids are handled; chromium .15 max., manganese .5 max., silicon .5 max., carbon 4-6, and molybdenum .45-.65.

Shelby tubing may be obtained in many additional grades from the lowest carbon boiler tube steel to the stainless grades of alloy steel which are available in tubing in all sizes up to 10¾ inches outside diameter. A number of steels made to S.A.E. standards are also furnished in Shelby tubing.

Castings furnished by Lorain Div.; Type A-1; carbon .3-.4, chromium .75-1, nickel 2.5-3, manganese .6-.8, and molybdenum .3-.4; Type A3; carbon .45-.55, chromium .75-.9, nickel .6-.8, manganese 1.5-2, and molybdenum .3-.4; and Type MS-1; carbon 1-14, chromium .75-1, manganese 10-14.

- - - - 5 - 7 - - -
Electrical steel sheets for use in transformers, motors and generators; eleven principal grades of electrical sheets furnished—U. S. S., Pole, Field, Armature, Electrical, Motor, Dynamo, Radio Transformer 72, and Transformer 72, 65, 58, and 52.

1 - - 4 - - - 8 - -
Other materials are furnished as follows: Carnegie-Illinois Steel Corp., stainless steel in sheets, plates, shapes and bars; National Tube Co., in pipe and tubular shape; and American Steel & Wire Co., in strip and wire forms.

- - 3 4 - 6 - - - -
U.S.S. AR STEEL (Abrasion Resisting Steel)—Carnegie-Illinois Steel Corp., Pittsburgh. Carbon .35-.5, manganese 1.5-2, phosphorus 05 max., sulphur .055 max., silicon .15-.3; furnished in bars or billets sheets, strip, plates and shapes; high abrasion resistance; brinell hardness 200-275 as rolled, heat treated 350-450. Used for wear resisting surfaces.

- - 3 4 - 6 - - - -
U.S.S. CARILLOY—Carnegie-Illinois Steel Corp., Pittsburgh. Alloy steels in all standard grades of S.A.E. steels sold under the above tradename

1 - - 4 5 - - - - -
U.S.S. COR-TEN—Carnegie-Illinois Steel Corp., Pittsburgh. Carbon .12 max., manganese .1-.5 max., silicon .35-1, copper .3-.5, chromium .5-1.5; furnished in bars or billets, sheets, strip, plates, structural and bar shapes, for hot and cold forming, welding, riveting, turning, etc. Resists atmospheric corrosion four to six times that of plain carbon steel; abrasion resistance, good; yield point 50,000 min.; tensile strength 70,000 min. lb. per sq. in., with exceptionally high ductility; bearing properties, good; weldability, good. Used for lightweight construction.

- - 3 4 5 - - - - -
U.S.S. MAN-TEN—Carnegie-Illinois Steel Corp., Pittsburgh. Carbon .3 max., manganese 1.1-1.6, phosphorus .04 max., silicon .3 max., sulphur .05 max., copper .2 min.; furnished in bars or billets, sheets, strip, plates, structural and bar shapes, for hot and cold forming, welding and riveting; corrosion-resistant; high abrasion resistance; yield point 50,000 min.; tensile strength 75,000 min. lb. per sq. in.; good ductility and weldability. Used for frames and light machine parts.

1 - - - - - 6 - - - - -
U-LOY—Republic Steel Corp., Cleveland. Copper-bearing steel with good corrosion resistance, available in hot rolled and galvanized sheets.

- - - - - - - - - - - - 10
ULTRA-CUT—Bliss & Laughlin Inc., Buffalo, N. Y. High sulphur bessemer screw stock furnished in cold finished bars, for miscellaneous automatic screw machine parts.

- - - 4 5 - - 8 - 10
UNION—Union Drawn Steel Div., Republic Steel Corp., Massillon, O.

- - - 4 - - - - - - 10
Freecut; carbon .08-.13 max., manganese .6-.9, phosphorus .09-.13, sulphur .16-.23; a free-cutting bessemer type steel.

Supercut; high-sulphur bessemer type; carbon .08-.13 max., manganese .6-.9, phosphorus .09-.13, and sulphur .24-.33.

- - - 4 5 - - - - - -
UNIVAN—Union Steel Casting Co., Pittsburgh. Nickel-vanadium alloy; tensile strength 90,000 lb. per sq. in.; for locomotive frames, crossheads, coupling boxes, driving wheel centers, etc.

1 - - - - - - - - - - -
VELVETOUCH—The S. K. Wellman Co., Cleveland, O. Friction materials made from sintered powdered metals welded to steel, consisting of a combination of various powdered metals such as copper, tin, lead and other powdered materials, compressed, sintered and welded to a solid metal backing for support. Applications include clutch and brake facings, clutch disks, thrust bearing steam seals, etc.

1 - 3 - - - - - - - -
VIBRO-ISOLATOR—Korfund Co., Long Island City, N. Y. Coiled steel spring vibration isolator for preventing shock and vibration transmission. Isolators can be used with or without concrete foundations for stationary and marine installations.

W

- - 3 4 - - - - - - - -
WEARTUF—Horace T. Potts Co., Philadelphia. Carbon-manganese-silicon abrasion-resisting alloy steel, furnished in sheets and plates, for hot forging, welding, forming, turning, boring, etc. Abrasion resistance, medium; ductility, low; good weldability; brinell hardness, untreated 265. Used for wear and abrasion resistant applications such as hoppers, chutes, conveyors and other similar types of parts.

- - 3 - - - - - - - - -
WEARWELD—Lincoln Electric Co., Cleveland; brinell hardness 488-548; suitable for hard-facing wearing surfaces subject to shocks and abrasion.

- - - 4 5 - - - - - -
WELLCAST 17 S—The Wellman Bronze & Aluminum Co., Cleveland. High-strength, aluminum-silicon-titanium alloy with high ductility; used in aircraft castings; tensile strength, 28-30,000 lb. per sq. in.

- - - - - - 7 - - -
WILCO CONTACT MATERIALS, Electrical—The H. A. Wilson Co., Newark, N. J. Silver, platinum, tungsten and alloy contacts; silver-steel laminated contacts for projection welding; silver composite contacts; silver and platinum inlay and overlay on base metals. Furnished in sheet and wire.

See advertisement, Page 189

- - - - - - 7 - - -
WILCO THERMOMETAL—The H. A. Wilson Co., Newark, N. J. Thermostatic bimetals furnished in strips and formed parts for temperature control and compensation.

See advertisement, Page 189

1 - - - 5 6 - - - - -
WOLVERINE—Wolverine Tube Div., Detroit.

1 - - - - 6 - - - - -
Aluminum brass; copper 76, zinc 22, aluminum 2; furnished in tubing; corrosion-resistant; medium abrasion-resistant; tensile strength 52-100,000 lb. per sq. in.; for bushings, condenser tubing.

Admiralty brass; copper 70, zinc 29, tin 1, residual phosphorus .001-.1; furnished in tubing; medium abrasion resistance; tensile strength 48-90,000 lb. per sq. in.; for condenser tubing.

1 - - - - - - - - -
70-30 brass; copper 70, zinc 30; furnished in tubing; corrosion resistant; medium abrasion-resistant; tensile strength 48-88,000 lb. per sq. in.; used for condenser tubing.

1 - - - 5 - - - - -
Red brass; copper 85, zinc 15; furnished in tubing; corrosion-resistant; medium abrasion resistance; tensile strength 40-69,000 lb. per sq. in.; high ductility; for condenser tubing.

1 - - - - 6 - - - -
Common high-brass; copper 66, lead .65 max., zinc balance; furnished in tubing; corrosion resistance; medium abrasion resistance; tensile strength 48-85,000 lb. per sq. in.; for cupped, formed or drawn parts, etc.

1 - - - 5 - - - - -
Copper, oxygen-free; copper and silver 99.9 min., phosphorus .015-.035 (optional as deoxidizer); furnished in tubing; corrosion-resistant; tensile strength 31-60,000 lb. per sq. in.; high ductility; for condensers, evaporators, heaters, condenser tubes, etc.

Copper, arsenical; copper and silver 99.2 min.; phosphorus .015-.035, arsenic .15-.50; balance is the same as oxygen-free copper.

Commercial bronze; copper 90, zinc 10; furnished in tubing; corrosion-resistant; available in color; medium abrasive resistance; tensile strength 36-63,000 lb. per sq. in.; high ductility; for ornamental purposes.

Low brass; copper 80, zinc 20; furnished in tubing; resists corrosion; medium abrasive resistance; high ductility; tensile strength 43-78,000 lb. per sq. in.; for bellows, ornamental purposes and fabricated parts.

1 - - - - 6 - - - -
Phosphorized arsenical Admiralty brass; copper 70, zinc 29, tin 1, phosphorus .015 max., arsenic .35 max.; furnished in tubing; corrosion-resistant; balance same as Admiralty.

- - - - - 6 - - - 10
High brass (2 & 1); free turning; copper 66, lead 1.75, zinc balance; furnished in tubing; corrosion-resistant; medium abrasion resistance; tensile strength 48-85,000 lb. per sq. in.; machinability; for screw machine parts and fabricated parts.

1 - - - - - - - - -
Naval brass; copper 60, tin .75, zinc balance; furnished in tubing; corrosion and abrasion resistance; tensile strength 55-100,000 lb. per sq. in.; used where corrosion resistance with high strength is required.

1 - - - - - - - - -
Muntz metal; copper 60, zinc 40, furnished in tubing; corrosion and abrasion resistance; tensile strength 48-85,000 lb. per sq. in.; for condenser tubes, etc.

1 - - - - - - - - -
Aluminum 2S; aluminum 99; furnished in tubing; ductility good; tensile strength 13-24,000 lb. per sq. in.; machinability, poor; used for airplane parts, oil burners, etc., where light weight is important.

Aluminum 3S; aluminum 97, manganese 1.25; furnished in tubing; ductility, good; tensile strength 16-29,000 lb. per sq. in.; machinability, good; used for airplane parts, oil burners, etc., where light weight is desired.

1-Corrosion resistant | 2-Heat resistant | 3-Abrasion resistant | 4-High tensile strength | 5-High ductility | 6-Bearing application | 7-Electrical uses | 8-Heat treating | 9-Low specific gravity | 10-Machinability

1 - 3 - - - - - - - -
WORTHITE—Worthington Pump & Machinery Corp., Harrison, N. J. Nickel 24, chromium 20, molybdenum 3, silicon 3.5, carbon .07 max., other elements 2, balance iron; furnished in finished rods or bars and as sand and centrifugal castings for turning, boring, welding, etc.; corrosion-resistant; heat resistance 2000-2200 degrees Fahr.; high abrasion resistance; tensile strength 97,000 lb. per sq. in. hot rolled, 72,000 lb. per sq. in. sand cast; medium ductility. Used for pumping equipment, valves, pipe fittings and special apparatus for corrosion resistance.

Y, Z

1 - - 4 5 - - - - -
YOLOY—The Youngstown Sheet & Tube Co., Youngstown, O. Carbon .05-.35, manganese .3-1.2, nickel 1-2, copper .75-1.25; special service alloy steel furnished in rough bars or billets, finished rods or bars, tubing, wire, sheets, coiled strip, and plates, for hot forging, stamping, extruding and welding. Mechanical properties in untreated state: ult. tensile strength, 70,000 lb. per sq. in. and up, depending on carbon and manganese content; yield point, 50,000 lb. per sq. in. min.; impact resistance, high; hardness, 130 and up (brinell), depending on analysis; weldability, excellent; good machinability.

- - - 4 - - - - - 10
Z-METAL—Ferrous Metals Corp., New York. Carbon 2-2.5, silicon 1, manganese .75-1, sulphur .08, phosphor .15; furnished as sand castings, resists heat up to 1000 degrees Fahr.; high abrasion resistance; tensile strength 75-90,000 lb. per sq. in.; compressive strength 125,000; medium ductility; good bearing properties; high yield point; for use as cams, cranks, gears, rocker arms. Licensees: Chain Belt Co., Gunite Foundries Corp., Acme Steel & Malleable Iron Works, Eastern Malleable Iron Co., Erie Malleable Iron Co., Arcade Malleable Iron Co., and Chicago Railway Equipment Co.

1 - - 4 5 - - - - -
ZAMAK—New Jersey Zinc Co., New York. Zinc alloys for die cast parts.
No. 2; aluminum 4.1, copper 2.7, magnesium .03, remainder Horse Head Special zinc.
No. 3; aluminum 4.1, magnesium .04, remainder Horse Head Special zinc.
No. 5; aluminum 4.1, copper 1.0, magnesium .04, remainder Horse Head Special zinc.
See advertisement Page 159

1 - - 4 5 - - - - -
ZILLOY—The New Jersey Zinc Co., New York. Rolled zinc alloys containing approximately 1 per cent copper. Furnished in sheets and strips for forming and stamping.
See advertisement, Page 159

1 - - - 5 - - - - -
ZINCGRIP—American Rolling Mill Co., Middletown, O. Galvanized sheet iron or steel, in strips or coils, with unusual forming and drawing qualities; for use wherever severe forming makes ordinary galvanized sheet metal unsatisfactory.

- - - - 5 - - - - -
Hot and cold-rolled steels; obtainable in ARMCO ingot iron and ARMCO high-tensile steel, copper-bearing steel and varying analyses of medium and low carbon steel. Available in sheet form; for severe forming requirements.

1 - - - 5 - - - - -
Long ternes; terne coated sheets with ingot iron, mild steel, or high-tensile steel base metal. For deep drawing requirements and paintability.

Spiral-welded pipe, in wall thicknesses of 7/64 to ½ inch, diameters 6 to 36 inches and lengths up to 50 feet; supplied mill coated, galvanized or bituminous coated and lined. Available standard or custombuilt fittings. Base metal mild or high tensile steel.

Producers of Iron, Steel and Nonferrous Metals

A

Acme Steel Co., 2840 Archer Ave., Chicago.
Colored strip steel—COLORSTRIP and SUPERSTRIP

Ajax Metal Co., 46 Richmond St., Philadelphia.
High tensile strength alloy—TOMBASIL

Alan Wood Steel Co., Conshohocken, Pa.
High-strength steel — "AW" DYN-EL and DYN-EL
Rolled-steel floor plate—"AW"

Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh.
Stainless steels—ALLEGHENY METAL
Special alloy tool steels—ATLAS No. 93, PYTHON and SEMINOLE
Nondeforming tool steel—DEWARD
Carbon tool steel—POMPTON
Electrical steels — ALLEGHENY-LUDLUM, MUMETAL and OHMALOY
Mild and stainless steel—PLURAMELT
See advertisement, Page 99

Allied Process Corp., 444 Madison Ave., New York.
Brass base alloy—AETERNA 600 METAL

Alloy Cast Steel Co., Marion, O.
Cast alloy steels—CAST ALLOY STEELS

Aluminum Co. of America, 634 Gulf Bldg., Pittsburgh.
Aluminum alloys—ALCOA
Aluminum casting alloys—LYNITE
Aluminum sheet—ALCLAD

Aluminum Industries Inc., 2438 Beekman St., Cincinnati.
Aluminum base alloys—PERMITE

American Agile Corp., 5806 Hough Ave., Cleveland.
Welding electrodes—AGILE-ACTARC

American Brass Co., Waterbury, Conn.
Copper-aluminum alloy—AVIALITE
Copper, aluminum and nickel alloy—TEMPALOY
Corrosion resistant alloys—AMBRAC, TOBIN BRONZE, ANACONDA, EVERDUR
See advertisements, Pages 92-93

American Crucible Products Co., 13050 Oberlin Ave., Lorain, O.
Bearing bronze—PROMET

American Magnesium Corp., 2210 Harvard Ave., Cleveland.
Magnesium alloy—MAZLO
See advertisement, Page 165

American Manganese Steel Div., The American Brake Shoe & Foundry Co., Chicago Heights, Ill.
Cast alloy steels and welding rods—AMSCO
Welding rod—MO-MANG
See advertisement, Page 179

American Nickeloid Co., 23 Second St., Peru, Ill.
Prefinished bonded-sheet and strip—NICKELOID, CHROMALOID, BRASSOID, COPPEROID. AMERICAN BONDED METALS and AMERICAN COPPER STEEL

American Smelting & Refining Co., Equitable Bldg., New York.
Cadmium-nickel bearing alloy—ASARCOLOY NO. 7
Lead-bearing alloy—"G" ALLOY

American Rolling Mill Co., Middletown, O.
Stainless and high tensile steels—ARMCO high silicon steel and pure iron—ARMCO ingot iron
Galvanized sheet iron or steel—ZINCGRIP and PAINTGRIP

American Steel & Wire Co., Rockefeller Bldg., Cleveland.
Carbon steels and alloys—AMERICAN QUALITY
Cold-finished steel bars—AMERCUT

Ampco Metal Inc., 1745 South 38th St., Milwaukee
Corrosion and shock-resistant alloys—AMPCO METAL
Coated welding rods—AMPCO-TRODE
Copper base alloys—AMPCOLOY
See advertisement, Page 88

Amplex Mfg. Co., Div. of Chrysler Corp., 6500 Harper Ave., Detroit.
(See Chrysler Corp.)

Anchor Drawn Steel Co., Latrobe, Pa.
High-carbon steel—RED ANCHOR

Apollo Metal Works, 6605 South Oak Park Ave., Chicago.
Pre-finished cold-rolled steel — APOLLO CHROM-STEEL

Apollo Steel Co., Apollo, Pa.
Copper-bearing steel—APOLLOY METAL

Aurora Metal Co., 614 West Park Ave., Aurora, Ill.
Aluminum-bronze alloy—AUROMET

B

Babcock & Wilcox Co., 85 Liberty St., New York.
Corrosion and heat-resisting alloys—ADAMANTINE and ELVERITE

Babcock & Wilcox Tube Co., Beaver Falls, Pa.
Corrosion and heat-resisting steel tubes—B & W CROLOY
See advertisement, Page 118

Baker & Co. Inc., 113 Astor St., Newark, N. J.
Platinum alloy—BAKER and PLATINUM-CLAD

Beckett Bronze Co., Muncie, Ind.
High-lead bronze—BECKETT METAL

Belle City Malleable Iron Co., Racine, Wis.
Pearlitic malleable iron—BELMALLOY
High-strength malleable iron—BELECTROMAL
Electric-furnace-melted cast iron—BELECTRIC

Bethlehem Steel Co., Bethlehem, Pa.
Copper-bearing steel—BETH-CU-LOY
High-carbon, manganese and nickel steels; and chromium-molybdenum steel castings—BETHLEHEM
High-temperature alloy steel—SUPERTEMP
Nickel-chromium steels—MAYARI

Bishop, J., & Co. Platinum Works, Malvern, Pa.
Stainless seamless tubing—BISHOP

Bliss & Laughlin Inc., P. O. Box 945, Buffalo, N. Y.
High-sulphur bessemer screw stock—ULTRA-CUT

Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit.
Light-aluminum alloy—BOHNALITE

Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.
Bearing bronzes—BOUND BROOK, COMPO
Porous iron bearing alloys—POWDIRON
See advertisement, Page 183

Bridgeport Brass Co., Bridgeport, Conn.
High-copper silicon bronzes—DURONZE
Copper and zinc alloys—BRIDGEPORT
Tubing—BRIDGEPORT TUBING

Buckeye Brass & Mfg. Co., 6410 Hawthorne, Cleveland.
Bearing bronzes—COMMERCIAL, HYSPEED and LUBRICO
See advertisement, Page 101

Buffalo Wire Works Co. Inc., 430 Terrace, Buffalo, N. Y.
Wire cloth—BUFFALO
See advertisement, Page 191

Bunting Brass & Bronze Co., Spencer and Carlton Sts., Toledo, O.
Bearing bronzes—BUNTING
See advertisement, Page 111

Burgess-Parr Co., Freeport, Ill.
Acid-resisting alloy—ILLIUM

C

Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh.
Nickel-bronze alloy—NICUITE
Babbitt metal—BEARITE and ACORN
Copper alloy—CUPALOY

Carboloy Co. Inc., 11177 East 8-Mile Rd., Detroit.
Cemented carbide—CARBOLOY

Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh.

Abrasion-resisting alloy—U. S. S. AR STEEL, U. S. S. CARILLOY, U. S. S. COR-TEN, U. S. S. MAN-TEN.

Carpenter Steel Co., Reading, Pa.
Carbon, chromium and chromium-nickel steels —CARPENTER
See advertisements, Pages 96, 97

Cerro de Pasco Copper Corp., 40 Wall St., New York.
Bismuth-lead-tin-antimony castings — CERROMATRIX, CERROBASE and CERROBEND

Chace, W. M., Co., 1614 Beard Ave., Detroit.
Thermostatic bimetal — CHACE THERMOSTATIC BIMETAL
See advertisement, Page 185

Chain Belt Co., 1604 W. Bruce St., Milwaukee.
High-tensile, corrosion-resistant alloy—REX Z METAL

Chambersburg Engineering Co., Chambersburg, Pa.
Nickel-molybdenum-iron alloys—CECOLLOY, CECOLLOY IRON

Chase Brass & Copper Co., Waterbury, Conn.
Corrosion-resistant copper alloys—OLYMPIC BRONZE, ANTIMONIAL ADMIRALTY, CHAMET BRONZE, CHASE TELLURIUM COPPER and CHASE

Chicago Steel Foundry Co., Kedzie Ave. and 37th St., Chicago.
High tensile strength castings—EVANSTEEL and PYRASTEEL

Chrysler Corp., Amplex Div., 6500 Harper Ave., Detroit.
Bearing bronze—OILITE
Machinery steel—AMOLA

Cleveland Tungsten Inc., 10200 Meech Ave., Cleveland.
Copper-tungsten electrodes—CELTALOY

Cleveland Twist Drill Co., The, 1242 East 49th St., Cleveland.
High-speed steel—MO-MAX

Climax Molybdenum Co., 500 Fifth Ave., New York.
Molybdenum steel—MO-LYB-DEN-UM
See advertisement, Page 169

Cold Metal Products Co., The, Youngstown, O.
Carbon and alloy strip steel—CMP STRIP
See advertisement, Page 86

Columbia Steel & Shafting Co., Woodkrik St., Pittsburgh, Pa.
High-tensile steel—COLUMBIA

Continental Roll & Steel Foundry Co., East Chicago, Ind.
Hard alloys for rolls—DUQUESNE SPECIAL, CROMONITE, HUBBARD SPECIAL, CRASFLOY CONTINENTAL SUPER STEEL
Alloy cast steels—DYNAMIC STEEL, TEMP ALLOY and MOLYBDENITE
See advertisement, Page 167

Copperweld Steel Co., Glassport, Pa.
Bearing alloy—ARISTOLOY
See advertisements, Pages 106, 171

Cramp Brass & Iron Foundries Div. Baldwin Locomotive Works, Philadelphia.
Copper alloys—CRAMP ALLOYS

Crucible Steel Co. of America, 405 Lexington Ave., New York.
High-strength alloy steels—DUPLEX, MAX-EL and SIMPLEX
Corrosion and heat-resistant alloys—LO CRO and RESISTAL
Forging steel—ALMO

D

Darwin & Milner Inc., 1260 West 4th St., Cleveland.
High-carbon, high-chrome steels—NEOR and COBALTCROM PRK-33

Detroit Alloy Steel Co., Ft. of Iron St., Detroit.
Alloy steel castings—KROKOLOY, CASTALOY, MARTIN STEEL, FLAMALOY
Oil-hardening steel castings—CARBOMANG

Doehler Die Casting Co., 386 Fourth Ave., New York.
Copper-zinc-silicon alloys — DOLER-BRASS, DOLER-ZINK
Magnesium base alloys—DOLER-MAG
Aluminum base die castings—DOLER-ALUMIN

Dole Valve Co., The, 1901 Carroll Ave., Chicago.
Thermostatic bimetal—DOLE

Dow Chemical Co., Midland, Mich.
Corrosion-resistant light alloys—DOWMETAL

Driver Co., Wilbur B., Riverside Ave., Newark, N. J.
Beryllium-copper alloys—BERALOY No. 25, CUPRON and TOPHET

Duraloy Co., Scottdale, Pa.
High-chrome, Iron and chrome-nickel alloys—DURALOY and DURASPUN

Duriron Co. Inc., Dayton, O. (and licensees—see Duriron in tradename listing).
Corrosion and heat-resistant alloys—ALCUMITE, DURICHLOR, DURIMET, DURIRON and DURCO

E

Eclipse Aviation Div., Bendix Aviation Corp., Philadelphia.
Seamless flexible metal hose—ECLIPSE

Electro Metallurgical Sales Corp., 30 East 42nd St., New York.
Ferro-alloy—ELECTROMET
See advertisement, Page 167

Erie Malleable Iron Co., Erie, Pa.
Abrasion and wear-resisting malleable iron—ERMAL, ERMALITE

Eutectic Welding Alloys Inc., 40 Worth St., New York
Welding alloys—CASTOLIN
See advertisement, Page 193

F

Fansteel Metallurgical Corp., North Chicago, Ill.
Corrosion-resistant alloy—FANSTEEL TANTALUM
High tensile strength alloy—FANSTEEL MOLYBDENUM

Farrell-Cheek Steel Co., Sandusky, O.
Abrasion-resisting cast steel—FARRELL's 85, FARRELL's HARD EDGE

Federal Mogul Corp., 11031 Shoemaker Ave., Detroit.
Bearing bronzes—FEDERAL
Babbitt bearing alloys—MOGUL
Lead base babbitt—BERMAX BABBITT

Ferrous Metals Corp., 444 Madison Ave., New York.
High abrasion-resistant alloy—Z-METAL

Firth-Sterling Steel Co., McKeesport, Pa.
Carbon tool steels—STERLING
Sintered carbides—FIRTHITE and FIRTHALOY
Stainless steels—STERLING-NIROSTA

Foote Bros. Gear and Machine Corp., 5301 S. Western Blvd., Chicago.
Nickel-molybdenum alloy—FIVEPOINT DEEP-HARD STEEL

Frank Foundries Corp., Moline, Ill.
Corrosion and abrasion-resistant alloys — FRANKITE

Frontier Bronze Corp., 818 Elmwood Ave., Niagara Falls, N. Y.
Heat and wear-resisting alloys—FRONTIER

G

General Electric Co., Schenectady, N. Y. (and licensees—see Alnico in tradename listing).
Magnet alloy—ALNICO
Welding electrodes—TRODALOY

General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Thermostatic metals—TRUFLEX

Gibson Electric Co., 585 Blvd. of the Allies, Pittsburgh.
High-ductility alloy—GIBSILOY

Globe Steel Tubes Co., Milwaukee.
Seamless steel tubing—GLOBE
See advertisement, Page 175

Graphite Metallizing Corp., 1050 Nepperhan Ave., Yonkers, N. Y.
Graphite and metal alloy—GRAPHALLOY

Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Detroit, Mich.
Impact-resistant alloy—DUCTILOY
High tensile alloy—N-A-X

Gunite Foundries Corp., Rockford, Ill.
Processed high-test cast iron—GUNITE

H

Handy & Harman, 82 Fulton St., New York.
Brazing alloys — HANDY FLUX, SILFOS, EASY-FLO

Hardy Inc., Charles, 415 Lexington Ave., New York.
Powdered metal—HARDY POWDERS

Harris & Co., Arthur, 210-218 North Aberdeen St., Chicago.
Copper-nickel alloy—DAIRYWHITE

Haynes Stellite Co., 205 E. 42nd St., New York.
Heat, corrosion and wear-resistant alloys—HAYNES STELLITE
Abrasion-resistant alloy — HAYNES STELLITE "93", HAYSTELLITE
Impact-resistant hard-facing rod — HASCHROME
Corrosion-resistant alloys—HASTELLOY
Cobalt-chromium-tungsten alloy—STELLITE

Heppenstall Co., Hatfield St., Pittsburgh.
Abrasion-resistant alloy steels — HARDTEM, KLEENKUT
High-strength alloy steel—HEPPENSTALL, HEPPENSTALL 5H50, EIS45
Nickel-chrome-molybdenum steel—EIS-57

Hoskins Mfg. Co., 4445 Lawton Ave., Detroit.
Heating element alloys—CHROMEL

I

Indium Corp. of America, 805 Watson Place, Utica, N. Y.
Lead-silver solder—INDIUM
See advertisement, Page 197

Ingersoll Steel & Disc Division, Borg-Warner Corp., 310 S. Michigan Ave., Chicago.
Stainless-clad steel—INGACLAD
Stainless steel—INGERSOLL

International Nickel Co. Inc., 67 Wall St., New York (and licensees).
Corrosion, heat and wear-resisting alloys—NI-TENSYLIRON, NI-HARD, NI-RESIST, NICKEL, MONEL and INCONEL
See advertisements, Pages 119, 161

J

Jeffrey Mfg. Co., The, First Ave. and Big Four railroad, Columbus, O.
High-strength malleable irons—PERDURO and SUPERMAL

Jessop Steel Co., Washington, Pa.
Nonmagnetic and stainless steels—JESSOP
Stainless-clad steel—SILVER-PLY
Stainless steels — DURO-GLOSS, HI-GLOSS and STA-GLOSS

Johnson Bronze Co., New Castle, Pa.
Bearing metals — JOHNSON, LEDALOYL, JSB
See advertisement, Page 157

Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh.
Free-machining steel—JALCASE
Forging steel—J & L CORRECT BALANCE

K

Keystone Carbon Co., Saint Marys, Pa.
Self-lubricating porous bronze—SELFLUBE
See advertisement, Page 195

Kitson Co., 1500 Walnut St., Philadelphia.
Virgin copper and lead alloy—OMAN METAL

Koppers Co., Bartlett-Hayward Div., Baltimore.
Bronze alloy—D-H-S BRONZE

Korfund Co., Long Island City, N. Y.
Coiled steel spring vibration isolator—VIBRO ISOLATOR

L

Lake City Malleable Co., 5060 Lakeside Ave., Cleveland.
Malleable iron—SHOCK PROOF
See advertisement, Page 202

La Salle Steel Co., 150th and Magnolia, Hammond, Ind.
High-tensile alloy—STRESSPROOF

Lebanon Steel Foundry, Lebanon, Pa.
Alloy cast steels—CIRCLE L

Lincoln Electric Co., 12818 Coit Rd., Cleveland.
High tensile welding rods — SHIELDARC, LIGHTWELD, MANGANWELD, WEARWELD, HARDWELD, ABRASOWELD, TOOLWELD, AERISWELD, FLEETWELD, STAINWELD, CHROMEWELD, FERROWELD, SOFTWELD, ALUMINWELD, READYWELD, SURFACEWELD, NICKELCHROMEWELD, PLANEWELD, TRANSWELD and FACEWELD

Linde Air Products Co., The, 205 42nd St., New York.
Welding rods—OXWELD
See advertisement, Page 103

Link-Belt Co., 220 S. Belmont Ave., Indianapolis.
Malleable cast iron—PROMAL

Lukens Steel Co., Coatesville, Pa.
Various types of steels—LUKENS

Lumen Bearing Co., 197 Lathrop Ave., Buffalo.
Wear-resisting—MACHINEBRONZE
High-tin babbitt—STANNUM BABBITT
Lead base bearing babbitt—LOTUS BABBITT
Bearing alloys—LUMEN ALLOYS

M

Magnus Metal Corp., 80 Jackson Blvd., Chicago (also 111 Broadway, New York)
Lead base alloy—SATCO Bearing Metal

McGill Mfg. Co., Valparaiso, Ind.
Corrosion-resistant alloys—McGILL

McKenna Metals Co., 1 Lloyd Ave., Latrobe, Pa.
Carbide alloys—KENNAMETAL
See advertisement, Page 110

Magnolia Metal Co., 120 Bayway, Elizabeth, N. J.
Babbitt metal—ADAMANT SUPER-GENUINE BABBITT, DEFENDER and PYRAMID
Bearing bronze—MAGNOLIA and MAGNOLIA Antifriction Metal

Mallory, P. R., & Co. Inc., Indianapolis.
Welding electrodes—ELKALOY
Wear-resistant alloy—ELKONITE
Copper base alloys—MALLORY

Manganese Steel Forge Co., Allen St. and Butler Ave., Philadelphia.
Forged alloy steel—ROL-MAN

Massillon Steel Casting Co., Massillon, O.
Alloy cast steel—MASSILLON, TIGERLOY
Nitriding steel—NITRALLOY

Meehanite Metal Corp., 311 Ross St., Pittsburgh (and licensees—see Mehanite in tradename listing).
Wear, heat and corrosion-resistant alloys—MEEHANITE
See advertisement, Page 201

Metal Carbides Corp., Youngstown, O.
Tungsten-carbide metal—TALIDE

Metal & Thermit Corp., 120 Broadway, New York.
Welding electrodes—MUREX

Metals Disintegrating Co. Inc., Elizabeth, N. J.
Powder metal—MD Metal Powders

Metals Refining Co., Hammond, Ind.
Powder metal—MRCO METAL POWDER

Molybdenum Corp. of America, Grant Bldg., Pittsburgh.
Molybdenum steel—MCA MOLYBDENUM
See advertisement, Page 94

Moraine Products Div., General Motors Corp., 1540 Wisconsin Blvd., Dayton, O.
Bearing alloys—DUREX, MORAINE
Powder metal—POREX

Morganite Brush Co. Inc., 3302 48th Ave., Long Island City, N. Y.
Carbon-graphite-metal—MORGANITE
See advertisement, Page 163

Mueller Brass Co., Port Huron, Mich.
Bearing alloy—MUELLER 600 Bearing Metal
See advertisement, Page 108

N

National Alloy Steel Division, Blawnox, Pa.
Corrosion-resisting castings—NA, NA-1, NA-2

National Bronze & Aluminum Foundry Co., East 88th and Laisy Ave., Cleveland.
Aluminum alloy—T-1
See advertisement, Page 83

National Erie Corp., Erie, Pa.
Steel castings—NELOY

National Malleable & Steel Castings Co., 10600 Quincy Ave., Cleveland.
Alloy cast steel—NACO
Malleable cast iron—MALLIX
Chromium-manganese-carbon alloy—NUREX
High-strength steel—NATIONAL Graphitic Steel

Neveroil Bearing Co., Wakefield, Mass.
Graphited metal bearings—GRAPHEX
Special bronze bearings—COPREX

New Jersey Zinc Co., 160 Front St., New York.
Zinc alloy—ZAMAK, ZILLOY
See advertisement, Page 159

Ney Co., The J. M., 71 Elm St., Hartford, Conn.
Corrosion-resistant alloys—PALINEY and NEY-ORO G

Nitralloy Corp., The, 230 Park Ave., New York (licensees—see Nitralloy in tradename listing).
Nitriding steel—NITRALLOY
See advertisement, Page 100

O, P

Ohio Seamless Tube Co., Shelby, O.,
Precision tubing—OSTUCO

Phosphor Bronze Smelting Co., 2216 Washington Ave., Philadelphia.
Phosphor bronze—ELEPHANT BRAND
See advertisement, Page 195

Pittsburgh Steel Co., Grant Bldg., Pittsburgh.
Stainless steels—PITTSBURGH STAINLESS

Horace T. Potts Co., E. Erie Ave. and D St., Philadelphia.
Chromium-molybdenum alloy — ELASTUF, CHRO-MOLY
Chromium-vanadium alloy—ELASTUF TYPE A
Chrome-nickel-molybdenum alloy — ELASTUF "44" and ELASTUF CHRO-MOLY
Carbon-manganese-silicon abrasion resisting steel—WEARTUF
Manganese type steel—ELASTUF PENN, STRAINFREE ELASTUF PENN
Free-machining case-hardening steel—ELASTUF C. H.

Precision Castings Co. Inc., Syracuse, New York.
Aluminum and zinc base alloys—PRECISION

R

Randall Graphite Products Corp., 609 W. Lake St., Chicago.
Graphite bronze bearings and bushings — RANDALL
See advertisement, Page 177

Republic Steel Corp., Republic Bldg., Cleveland.
Open-hearth iron alloy—TONCAN IRON
Stainless and heat-resisting alloys—ENDURO
High-strength alloy—REPUBLIC
Low-alloy, copper-nickel-molybdenum steel—REPUBLIC DOUBLE STRENGTH
Enameling stock—TONCAN IRON
Copper-bearing steel—U-LOY

Revere Copper & Brass Inc., 230 Park Ave., New York.
Nonmagnetic corrosion-resistant, silicon bronze—HERCULOY
Bearing bronze—ROMAN BRONZE
Condenser tubes and plates, REVALON and REVERE CUPRO-NICKEL, 30 per cent

Rhoades, R. W., Metaline Co. Inc., P. O. Box No. 1, Long Island City, N. Y.
Heat-resisting bearing bronze—METALINE

Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore.
Chromium and chromium-nickel stainless steels—DEFIRUST, DEFIHEAT, DEFISTAIN, RUSTLESS and RUSTLESS 17
Hardening-type stainless steel—RUSTLESS

Ryerson, Jos. T., & Son Inc., 16th and Rockwell St., Chicago.
Specially processed lead base alloys—GLYCO BABBITT

S

Saginaw Bearing Co., Saginaw, Mich.
Bearing bronzes—SABECO and AGRICOLA
See advertisement, Page 82

Saginaw Malleable Iron Div., Saginaw, Mich.
Bearing alloy—ARMASTEEL

Sandusky Foundry & Machine Co., Sandusky, O.
Nickel-chromium and molybdenum cast iron alloys—SANDUSKY ALLOY IRON
Bronze, brass and manganese bronze alloys—SANDUSKY BRONZES

Scovill Mfg. Co., Waterbury, Conn.
Copper alloys—ADNIC
Hardware bronze—SCOVILL
Spring material—OREIDE
Copper-lead-zinc alloy—SCOVILL FREE-CUTTING BRASS ROD
Copper-tin-zinc alloy — SCOVILL NAVAL BRASS
Copper tubing—SCOVILL Phosphorized Admiralty tubes

Sharon Steel Co., Sharon, Penna.
Stainless and heat-resisting alloy—SHARON

Shenango-Penn Mold Co., Dover, O.
High-strength alloys—SHENANGO-PENN
See advertisement, Page

Steel & Tubes Division, Republic Steel Corp., Cleveland.
Copper-bearing tubing—ELECTRUNITE

Stoody Co., Whittier, Calif.
Wear resisting alloys—STOODITE, STOODITE (Numbered), STOODY (Self-Hardening), SILFRAM, BORIUM
Welding rod—STOODITE K

Sumet Corp., 1543 Filmore Ave., Buffalo.
Bronze bearings—SUMET
See advertisement, Page 122

Summerill Tubing Co., Bridgeport, Montgomery Co., Pa.
Seamless tubing—SUMMERILL

Superior Metal Co., 66th Place at South Oak Park Ave., Chicago.
Copper-steel—SUPERIOR

Superior Steel Corp., Carnegie, Pa.
Stainless strip steel—SUPERIOR STAINLESS

T

Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Corrosion and abrasion-resistant alloys—TISCO
Austenitic wear-resisting steel—TIMANG

Thomas Steel Co., Warren, O.
Cold-rolled strip steel—THOMASTRIP

Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.
Abrasion-resistant bearing alloys — GRAPH-TUNG, GRAPH-SIL, GRAPH-MO, GRAPH-M.N.S, GRAPH-AL
Creep-resisting alloy steels—DM STEEL, DM-45, SICROMO STEEL
Heat-resistant alloys—SILMO, TIMKEN 17-22A

Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Extra low carbon trimming steel—TAMCO
See advertisement, Page 199

True Alloys Inc., 1820 Clay St., Detroit.
Aluminum-bronze alloys—TRUALOY

U

Union Drawn Steel Div., Republic Steel Corp., Massillon, O.
Cold-drawn steels—UNION

Union Steel Casting Division, 62nd and Butler Sts., Pittsburgh.
Nickel-vanadium steel—UNIVAN

Unitcast Corp., Steel Casting Div., Toledo, O.
Cast steels—TOLEDO ALLOY
See advertisement, Page 200

United States Graphite Co., Saginaw, Mich.
Bearing bronze—GRAMIX
Graphitic carbon—GRAPHITIC CARBON
See advertisement, Page 90

United States Steel Corp., 434 Fifth Ave., Pittsburgh. (See Carnegie-Illinois Steel Corp.)
Stainless steels, Shelby tubing, castings, and electrical steel sheets—USS
Atmospheric corrosion and abrasion-resistant alloys—U.S.S. COR-TEN, and U.S.S. MAN-TEN

W

Wellman, S. K., The, 1374 E. 51st St., Cleveland.
Friction material—VELVETOUCH

Wellman Bronze & Aluminum Co., 6017 Superior Ave., Cleveland.
Copper-tin-zinc-lead alloys—IDEALOY, ANFRILOY
Aluminum-silicon-titanium alloy—WELLCAST 17S

Western Cartridge Co., East Alton, Ill.
Brasses, phosphor bronzes and nickel silvers—WESTERN

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Corrosion and heat-resisting alloy—KONAL, PHOS-COPPER, K-42-B
Magnetic alloy—HIPERNIK
Gas type metal—KOVAR
Copper base alloy—CUPALOY
Iron-cobalt-alloy—CUFERCO

Wheelock, Lovejoy & Co. Inc., 128 Sidney St., Cambridge, Mass.
Machinery steels—ECONOMO, HYTEN

Wilson, H. A., Co., 105 Chestnut St., Newark, N. J.
Thermostatic bimetal — WILCO THERMO-METAL and WILCO Contact Materials
See advertisement, Page 189

Wolverine Tube Div., 1411 Central Ave., Detroit.
Tubing—WOLVERINE

Worthington Pump & Machinery Corp., Harrison, N. J.
Corrosion and abrasion-resistant alloy — WORTHITE

Y

Youngstown Sheet & Tube Co., Youngstown, O.
High tensile strength alloy—TRANTINYL

Youngstown Sheet & Tube Co., Youngstown, O.
High strength alloy steel—YOLOY

Index of Alloys
by Principal Constituents

OFTEN the engineer responsible for design selects the material for a machine part according to the base metal and certain alloying elements which are known to influence the properties in a desired direction. To provide the designer with a key between alloying constituents and tradenames the accompanying cross-reference index has been compiled.

Further information on each alloy may be obtained by referring to the alphabetical listing by tradenames under "Metals", commencing Page 123. The index does not attempt to show the relative proportions of elements present in each alloy nor even to list all constituents.

Tradenamed alloys are listed primarily under the base metal or predominating element or, in some cases such as bearing metals, under primary use. In general each alloy is listed only once. Alloying elements which control the properties of the material are arranged alphabetically as subheads under the main heads. In a few cases additional elements which exercise a controlling influence are indicated in italics following the tradename.

IRON AND STEEL

Cr.
- B & W Croloy
- Bethlehem
- Bishop
- Carpenter
- Chromeweld 4-6
- Circle L
- Defiheat
- Defirust
- Duro-Gloss
- Dynamic Steel
- Eis 45
- Enduro
- Globe
- Ingersoll
- Kleen-Cut
- Krokoloy (*CoMo*)
- Lo-Cro
- Neor
- Ohmaloy (*Al*)
- Pittsburgh Stainless
- Rezistal
- Rustless
- Silverply
- Sta-Gloss
- Sterling
- Summerill
- Superior
- Temp Alloy
- U. S. S.
- U. S. S. Cor-Ten

Cr-Mo
- Amsco
- Atlas No. 93
- B & W Croloy
- Bethlehem 88-80
- Castoloy (*Co*)
- Cecolloy
- Circle L
- Cobaltcrom-PRK-33 (*CoSi*)
- DM-45
- DM Steel
- Elastuf (*V*)
- Electrunite
- Farrell's 85
- Hardtem (*V*)
- Heppenstall 5 H 50 (*V*)
- Martin Steel (*Co*)
- Molybdenite
- Nitralloy (*Al*)
- Pyrasteel (*Si*)

Cr-Mo-Ni
- Cast Alloy Steel
- Sicromo (*Si*)
- Summerill
- Superior
- Timken
- Tisco
- U. S. S.

Cr-Ni
- Allegheny Metals
- Amsco
- Apollo Chromsteel
- Armco
- B & W Croloy
- Carpenter
- Cast Alloy Steel
- Chromel
- Circle L
- Defistain
- Duraloy
- Durco
- Durimet
- Electrunite
- Enduro
- Evansteel
- Fahrite
- Frankite
- Hi-Gloss
- Hubbard Special
- Ingaclad
- Jessop
- Mayari
- Mumetal (*Cu*)
- NA. NA-1, NA-2
- Ni-Hard
- Pittsburgh Stainless
- Pyrasteel
- Rezistal
- Rustless
- Sharon
- Sterling-Nirosta
- Summerill
- Superior
- Timken
- Tisco
- U. S. S.

Cr-Mn
- Adamantine
- Carbomang
- Flamaloy (*CuMo*)
- Hy-Ten (*Mo*)
- Lukens
- Nurex
- Supertemp (*W*)
- Circle L
- Continental Super Steel
- Duquesne Special
- Dynamic Steel
- Eis 57
- Elastuf "44"
- Elastuf Chro-Moly
- Fivepoint Deephard Steel
- Heppenstall 2 C 30
- Hy-Ten
- Timken
- Tisco
- Worthite

Cr-V-W
- Mo-Max (*Mo*)
- Seminole

Cu
- Beth-Cu-Loy
- Copperweld
- U-Loy
- Yoloy (*Ni*)

Mn
- Amsco
- Apolloy Metal (*Cu*)
- Cast Alloy Steel
- Circle L
- Dynamic Steel (*V*)
- Naco
- Rol-Man
- Strainfree Elastuf
- Stressproof
- Tisco
- Toledo Alloy (*V*)
- U.S.S. Man-Ten

Mn-Mo
- Amola
- Cast Alloy Steel
- Circle L (*Cr*)
- Deward
- Dynamic Steel
- Lukens
- Max-El
- Mo-Mang

Mn-Ni
- Amsco
- Dynamic Steel
- Timang

Mn-Mo-Ni
- Dynamic Steel
- Republic (*Cu*)

Mn-Si
- Bethlehem
- Carpenter
- Cecolloy Iron
- Columbia
- Ductiloy (*CrNi*)
- Graph-Sil
- N-A-X High Tensile (*CrNi*)
- Weartuf
- Z-Metal

Mo
- Circle L
- Economo
- Lukens
- Timken
- U.S.S.

Mo-Ni
- Bethlehem
- Cecolloy
- Circle L
- Fivepoint Deephard Steel
- Republic Double Strength (*Cu*)
- Tigerloy

Ni
- Allegheny Ludlum
- Alnico (*AlCo*)
- Carpenter
- Cast Alloy Steel
- Dynamic Steel
- Graph-M.N.S. (*SiMoCrMn*)
- Kovar (*Co*)
- Lukens
- Ni-Resist (*CuCrSiMn*)
- Ni-Tensyliron
- Univan (*V*)
- Yoloy (*Cu*)

S
- Ultra-Cut
- Union

Mo-Si
- Durichlor
- Graph-Mo
- Silmo
- Toledo Alloy

Si
- Allegheny Ludlum
- Armco
- Duriron

Other Alloy Steels
- Graph-Al (*Al*)
- Python (*V*)
- Tamco (*Ti*)

Alloy Cast Iron
- Cecolloy
- Crasfloy
- Elverite
- Frankite
- Gumite
- Meehanite
- Ni-Hard
- Ni-Resist
- Ni-Tensyliron
- Sandusky Alloy Iron (*NiCrMo*)
- Shenango-Penn
- Z-Metal

Malleable Iron
- Belectric
- Belectromal
- Belmalloy
- Ermal
- Ermalite
- Mallix
- Perduro
- Promal
- Shock Proof
- Supermal

Special Steels (not otherwise classified)
- Amercut
- American Quality
- Aristoloy
- CMP Strip

Colorstrip
Elastuf Penn
Electromet
Farrell's Hard Edge
Massillon
National Graphitic Steel
Pluramelt
Pompton
Red Anchor
Rex Z Metal
Superior
Superstrip
Thomastrip
Zincgrip

Iron

Armco
MRCO Metal Powder
Toncan Iron

ALUMINUM BASE

Al and Al Alloys

Alclad
Alcoa
Bohanlite
Doler-Alumin
Lynite
M.D. Metal Powders
Permite
Precision
T-l Aluminum
Tamco
Trualoy
Wellcast 178
Wolverine

BEARING METALS

Babbitt

Acorn
Adamant Super-Genuine
Bearite
Bermax
Bunting
Defender Metal
Glyyco Babbitt
Graphex
Johnson
Lotus Babbitt
Lumen Alloys
Magnolia
Mogul Babbitt
Pyramid Metal
Stannum Babbitt

Other Bearing Metals

Agricola
Anfriloy
Asarcoloy
Beckett Metal
Bound Brook
Bunting
Commercial
Compo
Coprex
Cramp Alloys
Durex
Federal Bronzes
G Alloy
Gramix
Graphalloy
Hy-Speed
Graphex
Idealoy
JSB
Johnson
Ledaloyl
Lubrico
Lumen Alloys
Machine Bronze
Magnolia
Metaline
Moraine
Mueller 600
Oilite
Porex
Powdiron
Promet
Rendall
Sabeco
Satco
Selflube
Sumet
Trualoy

BIMETALS

Chase Thermostatic
Dole Thermostatic
Truflex
Wilco Thermometal

CADMIUM BASE

Cd and Cd Alloys

M.D. Metal Powders

CARBON BASE

Morganite
Graphitar

COBALT BASE

Kennametal

BISMUTH BASE

Bi and Bi Alloys

Cerrobase
Cerrobend
Cerromatrix
M.D. Metal Powders

COPPER BASE

High Copper

Anaconda
Bridgeport
Elkaloy
Elkonite
Mallory
M.D. Metal Powders
MRCO Metal Powder
Trualoy
Wolverine

Cu-Ag

Cupaloy
Sil-Fos
Wolverine

Cu-Al

Auromet
Avialite
Lumen Alloys
Frontier
McGill
Tempaloy
Trualoy

Cu-Al-Fe

Alcumite
Ampcoloy
Ampco Metal
Ampco-Trode

Cu-Be

Anaconda
Beraloy No. 25

Cu-Ni

Adnic
Ambrac
Anaconda
Bridgeport Tubing
Chase
Copel
Cupron
Dairywhite
Frontier
Lumen Alloys
Revere Cupro-Nickel
Summerill
Western

Cu-Pb

Oman Metal

Cu-Pb-Zn

Chase
Scovill Free-Cutting Brass
Scovill Hardware Bronze
Wolverine

Cu-Si

Auromet
Bridgeport Tubing
Duronze
Everdur
Herculoy
McGill
Olympic Bronze

Cu-Sn

Anaconda
Bridgeport
Eclipse
Elephant Brand
Frontier
Lumen Alloys
Sandusky Bronzes
Shenango-Penn
Western

Cu-Sn-Zn

Antimonial Admiralty (*Sb*)
Bridgeport Tubing
Chamet Bronze
Oreide
Roman Bronze
Scovill
Scovill Naval Brass
Tobin Bronze
Wolverine

Cu-Zn

Aeterna 600 Metal (*MnSi*)
Anaconda
Bridgeport
Bridgeport Tubing
D-H-S Bronze (*AlFeMn*)
Doler-Brass
Lumen Alloys
M.D. Metal Powders
Mueller 600 Bronze
Revalon (*Al*)
Sandusky Bronzes
Tombasil (*Si*)
Western
Wolverine

Other Cu Alloys

Chase Tellurium Copper (*Te*)
Cuferco (*FeCo*)
Cupaloy (*AgCr*)
Sil-Fos (*AgP*)
Wolverine

ELECTRODES

Abrasoweld
Aerisweld
Agile
Aluminweld
Castolin
Chromeweld 4-6
Faceweld
Ferroweld
Fleetweld
Hardweld
Hascrome
Haynes Stellite
Lightweld
Manganweld
Murex
Nickelchromeweld
Oxweld
Planeweld
Readyweld
Shieldarc
Softweld
Stainweld
Stoodite "K"
Surfaceweld (powder)
Toolweld
Transweld
Trodaloy
Wearweld

LEAD BASE

Pb and Pb Alloys

Indium (*Ag In*)
MD Metal Powders
MRCO Metal Powder

MAGNESIUM BASE

Mg and Mg Alloys

Mazlo
Doler-Mag
Dowmetal

MOLYBDENUM BASE

Mo and Mo Alloys

Fansteel Molybdenum
MCA Molybdenum
M.D. Metal Powders
Mo-Lyb-Den-Um
Tamco

NICKEL BASE

Ni and Ni Alloys

Chromel (*Cr*)
Hastelloy
Hipernik (*FeMn*)
Illium (*Cr*)
Inconel (*Cr*)
K-42-B (*Co*)
Konal (*Co*)
MD Metal Powders
Monel (*Cu*)
Nickel
Shenango-Penn (*Cu*)
Tamco
Tophet

PLATINUM BASE

Pt and Pt Alloys

Baker
Ney-Oro G (*Au*)
Paliney (*Pb*)
Platinum-Clad
Wilco

POWDER METAL

Durex
Hardy Powders
MD Metal Powders
MRCO Metal Powder
Porex

SILVER BASE

Ag and Ag Alloys

Easy-Flo
Elkonite
Gibsiloy
Handy Flux
MD Metal Powders
Wilco Contact Materials

TANTALUM

Fansteel Tantalum

TITANIUM

Tamco

TUNGSTEN BASE

W

Mallory

W-Ag

Cletalloy
Wilco (*Pt*)

W-C

Carboloy
Firthaloy
Firthite (*Co*)
Haystellite
Talide

W-Cu

Cletalloy

ZINC BASE

Zn and Zn Alloys

Brassoid
Chromaloid
Copperoid
Doler-Zink
M.D. Metal Powders
Nickeloid
Precision
Zamak (*Al*)
Zillony (*Cu*)

New Standard Steel Classifications

	SAE No.	AISI or NE No.	C	Mn	P(max.)	S(max.)	Si	Ni	Cr	Mo	Low Alloy Alternatives
			Chemical Composition Limits, Per Cent								
Carbon Steels	1008	C 1008	.10 max.	.30- .50	.040	.050	......	......	......	......	......
	1010	C 1010	.08-.13	.30- .50	.040	.050	......	......	......	......	......
	1015	C 1015	.13-.18	.30- .50	.040	.050	......	......	......	......	......
	1016	C 1016	.13-.18	.60- .90	.040	.050	......	......	......	......	......
	1020	C 1020	.18-.23	.30- .50	.040	.050	......	......	......	......	......
	1022	C 1022	.18-.23	.70-1.00	.040	.050	......	......	......	......	......
	1024	C 1024	.20-.26	1.35-1.65	.040	.050	......	......	......	......	......
	1025	C 1025	.22-.28	.30- .50	.040	.050	......	......	......	......	......
	1030	C 1030	.28-.34	.60- .90	.040	.050	......	......	......	......	......
	1035	C 1035	.32-.38	.60- .90	.040	.050	......				......
	1036	C 1036	.32-.39	1.20-1.50	.040	.050	......				......
	1040	C 1040	.37-.44	.60- .90	.040	.050	......				......
	1045	C 1045	.43-.50	.60- .90	.040	.050	......				......
	1050	C 1050	.48-.55	.60- .90	.040	.050	......				......
	1052	C 1052	.47-.55	1.20-1.50	.040	.050	......				......
	1055	C 1055	.50-.60	.60- .90	.040	.050	......				......
	1060	C 1060	.55-.65	.60- .90	.040	.050	......				......
	1066	C 1066	.60-.71	.80-1.10	.040	.050	......				......
	1070	C 1070	.65-.75	.70-1.00	.040	.050	......				......
	1080	C 1080	.75-.88	.60- .90	.040	.050	......				......
	1085	C 1085	.80-.93	.70-1.00	.040	.050	......				......
	1095	C 1095	.90-1.05	.30- .50	.040	.050	......				......
Free Cutting Steels	1111	B 1111	.08-.13	.60- .90	.09-.13	.10-.15	......				......
	1112	B 1112	.08-.13	.60- .90	.09-.13	.16-.23	......				......
	1113	B 1113	.08-.13	.60- .90	.09-.13	.24-.33	......				......
	1115	C 1115	.13-.18	.70-1.00	.045	.10-.15	......	......	......	......	......
	1117	C 1117	.14-.20	1.00-1.30	.045	.08-.13	......	......	......	......	......
	1118	C 1118	.14-.20	1.30-1.60	.045	.08-.13	......	......	......	......	......
	1132	C 1132	.27-.34	1.35-1.65	.045	.08-.13	......	......	......	......	......
	1137	C 1137	.32-.39	1.35-1.65	.045	.08-.13	......	......	......	......	......
	1141	C 1141	.37-.45	1.35-1.65	.045	.08-.13	......	......	......	......	......
	1145	......	.42-.49	.70-1.00	.045	.04-.07	......	......	......	......	......
Manganese Steels	1320	A 1320	.18-.23	1.60-1.90	.040	.040	.20-.35	......	......	......	......
	1330	NE 1330	.28-.33	1.60-1.90	.040	.040	.20-.35	......	......	......	......
	1335	NE 1335	.33-.38	1.60-1.90	.040	.040	.20-.35	......	......	......	......
	1340	NE 1340	.38-.43	1.60-1.90	.040	.040	.20-.35	......	......	......	......
		NE 1345	.43-.48	1.60-1.90	.040	.040	.20-.35	......	......	......	......
		NE 1350	.48-.53	1.60-1.90	.040	.040	.20-.35	......	......	......	......
Nickel Steels	2317	A 2317	.15-.20	.40- .60	.040	.040	.20-.35	3.25-3.75	......	......	NE 8020, 9420
	2330	A 2330	.28-.33	.60- .80	.040	.040	.20-.35	3.25-3.75	......	......	NE 1330, 9430, 9630
	2340	A 2340	.38-.43	.70- .90	.040	.040	.20-.35	3.25-3.75	......	......	NE 1345, 9442, 9642
	2345	A 2345	.43-.48	.70- .90	.040	.040	.20-.35	3.25-3.75	......	......	NE 1350, 9445, 9645
	2515	A 2515	.12-.17	.40- .60	.040	.040	.20-.35	4.75-5.25	......	......	NE 8720, 9420
Nickel Chromium Steels	3115	A 3115	.13-.18	.40- .60	.040	.040	.20-.35	1.10-1.40	.55- .75	......	NE 8020, 9420
	3120	A 3120	.17-.22	.60- .80	.040	.040	.20-.35	1.10-1.40	.55- .75	......	NE 8020, 9420
	3130	A 3130	.28-.33	.60- .80	.040	.040	.20-.35	1.10-1.40	.55- .75	......	NE 1330, 9430, 9630
	3135	A 3135	.33-.38	.60- .80	.040	.040	.20-.35	1.10-1.40	.55- .75	......	NE 1335, 9435, 9635
	3140	A 3140	.38-.43	.70- .90	.040	.040	.20-.35	1.10-1.40	.55- .75	......	NE 1345, 9440, 9640
	3141	A 3141	.38-.43	.70- .90	.040	.040	.20-.35	1.10-1.40	.70- .90	......	NE 1345, 9442, 9642
	3145	A 3145	.43-.48	.70- .90	.040	.040	.20-.35	1.10-1.40	.70- .90	......	NE 1350, 9445, 9645
	3150	A 3150	.48-.53	.70- .90	.040	.040	.20-.35	1.10-1.40	.70- .90	......	NE 9450, 9650
	3240	A 3240	.38-.45	.40- .60	.040	.040	.20-.35	1.65-2.00	.90-1.20	......	NE 1345, 9442, 9642
	3310	E 3310	.08-.13	.45- .60	.025	.025	.20-.35	3.25-3.75	1.40-1.75	......	......
Molybdenum Steels	4023	A 4023	.20-.25	.70- .90	.040	.040	.20-.35	......	......	.20-.30	NE 8020, 9420
	4027	A 4027	.25-.30	.70- .90	.040	.040	.20-.35	......	......	.20-.30	NE 8022, 9422
	4032	A 4032	.30-.35	.70- .90	.040	.040	.20-.35	......	......	.20-.30	NE 8022, 9422
	4037	A 4037	.35-.40	.75-1.00	.040	.040	.20-.35	......	......	.20-.30	NE 1330, 9430, 9630
	4042	A 4042	.40-.45	.75-1.00	.040	.040	.20-.35	......	......	.20-.30	NE 1330, 9430, 9630
	4047	A 4047	.45-.50	.75-1.00	.040	.040	.20-.35	......	......	.20-.30	NE 1335, 9430, 9630
	4063	A 4063	.60-.67	.75-1.00	.040	.040	.20-.35	......	......	.20-.30	NE 9255, 9260, 9262
	4068	A 4068	.64-.72	.75-1.00	.040	.040	.20-.35	......	......	.20-.30	NE 9255, 9260, 9262
	4119	A 4119	.17-.22	.70- .90	.040	.040	.20-.35	......	.40- .60	.20-.30	NE 8020, 9420
	4125	A 4125	.23-.28	.70- .90	.040	.040	.20-.35	......	.40- .60	.20-.30	......
	4130	A 4130	.28-.33	.40- .60	.040	.040	.20-.35	......	.80-1.10	.15-.25	NE 1330, 9430, 9630
	4137	A 4137	.35-.40	.70- .90	.040	.040	.20-.35	......	.80-1.10	.15-.25	NE 1340, 9437, 9637
	4140	A 4140	.38-.43	.75-1.00	.040	.040	.20-.35	......	.80-1.10	.15-.25	NE 1345, 9440, 9640
	4145	A 4145	.43-.48	.75-1.00	.040	.040	.20-.35	......	.80-1.10	.15-.25	NE 1350, 9445, 9645
	4150	A 4150	.46-.53	.75-1.00	.040	.040	.20-.35	......	.80-1.10	.15-.25	NE 9450, 9650
	4320	A 4320	.17-.22	.45- .65	.040	.040	.20-.35	1.65-2.00	.40- .60	.20-.30	NE 8720, 9422
	4340	A 4340	.38-.43	.60- .80	.040	.040	.20-.35	1.65-2.00	.70- .90	.20-.30	NE 9537, 9540

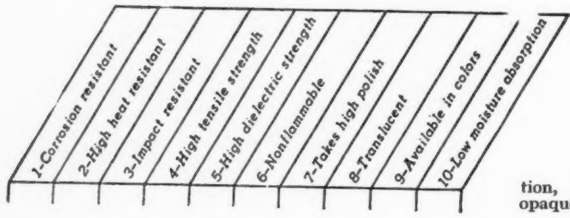
STANDARD steels here listed include all the current SAE steels and NE steels. Because of the necessity of conserving critical alloying materials, the plain carbon and low alloy steels must be used in preference to the higher alloy steels wherever possible. The NE steels listed in the final column as alternatives are those having approximately the same hardenability values and, in many cases, the same general charasteristics.

	SAE No.	AISI or NE No.	C	Mn	P(max.)	S(max.)	Si	Ni	Cr	Mo	Low Alloy Alternatives
			Chemical Composition Limits, Per Cent								
	4615	A 4615	.13-.18	.45- .65	.040	.040	.20-.35	1.65-2.00	....	.20-.30	NE 8020, 9420
	4620	A 4620	.17-.22	.45- .65	.040	.040	.20-.35	1.65-2.00	....	.20-.30	NE 8020, 9420
	4640	A 4640	.38-.43	.60- .80	.040	.040	.20-.35	1.65-2.00	....	.20-.30	NE 1340, 9437, 9637
	4815	A 4815	.13-.18	.40- .60	.040	.040	.20-.35	3.25-3.75	....	.20-.30	NE 8715, 9420
	4820	A 4820	.18-.23	.50- .70	.040	.040	.20-.35	3.25-3.75	....	.20-.30	NE 8720, 9426
Chromium Steels	5120	A 5120	.17- .22	.70- .90	.040	.040	.20-.35	....	.70- .90	......	NE 8020, 9420
	5140	A 5140	.38- .43	.70- .90	.040	.040	.20-.35	....	.70- .90	......	NE 1335, 9435, 9635
	5150	A 5150	.48- .55	.70- .90	.040	.040	.20-.35	....	.70- .90	......	NE 1350, 9445, 9645
	52100	E 52100	.95-1.10	.30- .50	.025	.025	.20-.35	....	1.20-1.50	......	NE 52100A
	....	NE 52100A	.95-1.10	.25- .45	.030	.040	.20-.35	.35 Max.	.40- .60	.08 Max.	....
	....	NE 52100B	.95-1.10	.25- .45	.030	.040	.20-.35	.35 Max.	.90-1.15	.08 Max.	....
	....	NE 52100C	.95-1.10	.25- .45	.030	.040	.20-.35	.35 Max.	1.30-1.60	.08 Max.	....
Chromium Vanadium Steel	6150†	....	.48-.55	.65- .90	.040	.040	.20-.35	....	.80-1.10	......	NE 1350, 9445, 9645
Manganese Molybdenum Steels	....	NE 8020	.18-.23	1.00-1.30	.040	.040	.20-.35	....	....	.10-.20	....
	....	NE 8022	.20-.25	1.00-1.30	.040	.040	.20-.35	....	....	.10-.20	....
	....	NE 8339	.35-.42	1.30-1.60	.040	.040	.20-.35	....	....	.20-.30	NE 1335, 9430, 9630
	....	NE 8442	.40-.45	1.30-1.60	.040	.040	.20-.35	....	....	.30-.40	NE 1345, 9442, 9642
Nickel Chromium Molybdenum Steels	....	NE 8613	.12-.17	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.15-.25	....
	....	NE 8615	.13-.18	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.15-.25	....
	....	NE 8617	.15-.20	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.15-.25	....
	....	NE 8620	.18-.23	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.15-.25	NE 8020, 9420
	....	NE 8630	.28-.33	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.15-.25	NE 1330, 9430, 9630
	....	NE 8715	.13-.18	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.20-.30	....
	....	NE 8720	.18-.23	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.20-.30	NE 9420
	....	NE 8722	.20-.25	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.20-.30	....
	....	NE 8735	.33-.38	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.20-.30	NE 1335, 9435, 9635
	....	NE 8739	.35-.40	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.20-.30	NE 1340, 9437, 9637
	....	NE 8744	.40-.45	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.20-.30	NE 1345, 9442, 9642
	....	NE 8749	.45-.50	.70- .90	.040	.040	.20-.35	.40- .60	.40- .60	.20-.30	....
	....	NE 8949	.45-.50	1.00-1.30	.040	.040	.20-.35	.40- .60	.40- .60	.30-.40	NE 9450, 9650
Silicon Manganese Steels	....	NE 9255	.50-.60	.70- .95	.040	.040	1.80-2.20	....	....	......	....
	9260	NE 9260	.55-.65	.75-1.00	.040	.040	1.80-2.20	....	....	......	....
	....	NE 9262	.55-.65	.75-1.00	.040	.040	1.80-2.20	....	.20- .40	......	....
Manganese Silicon Chromium Nickel Molybdenum Steels	....	NE 9415	.13-.18	.80-1.10	.040	.040	.40-.60	.20- .40	.20- .40	.08-.15	....
	....	NE 9420	.18-.23	.80-1.10	.040	.040	.40-.60	.20- .40	.20- .40	.08-.15	....
	....	NE 9422	.20-.25	.80-1.10	.040	.040	.40-.60	.20- .40	.20- .40	.08-.15	....
	....	NE 9430	.28-.33	.90-1.20	.040	.040	.40-.60	.20- .40	.20- .40	.08-.15	....
	....	NE 9435	.33-.38	.90-1.20	.040	.040	.40-.60	.20- .40	.20- .40	.08-.15	....
	....	NE 9437	.35-.40	.90-1.20	.040	.040	.40-.60	.20- .40	.20- .40	.08-.15	....
	....	NE 9440	.38-.43	.90-1.20	.040	.040	.40-.60	.20- .40	.20- .40	.08-.15	....
	....	NE 9442	.40-.45	1.00-1.30	.040	.040	.40-.60	.20- .40	.20- .40	.08-.15	....
	....	NE 9445	.43-.48	1.00-1.30	.040	.040	.40-.60	.20- .40	.20- .40	.08-.15	....
	....	NE 9450	.48-.53	1.20-1.50	.040	.040	.40-.60	.20- .40	.20- .40	.08-.15	....
	....	NE 9537	.35-.40	1.20-1.50	.040	.040	.40-.60	.40- .60	.40- .60	.15-.25	....
	....	NE 9540	.38-.43	1.20-1.50	.040	.040	.40-.60	.40- .60	.40- .60	.15-.25	....
	....	NE 9542	.40-.45	1.20-1.50	.040	.040	.40-.60	.40- .60	.40- .60	.15-.25	....
	....	NE 9550	.48-.53	1.20-1.50	.040	.040	.40-.60	.40- .60	.40- .60	.15-.25	....
Manganese Silicon Chromium Steels	....	NE 9630	.28-.33	1.20-1.50	.040	.040	.40-.60	....	.40- .60	......	....
	....	NE 9635	.33-.38	1.20-1.50	.040	.040	.40-.60	....	.40- .60	......	....
	....	NE 9637	.35-.40	1.20-1.50	.040	.040	.40-.60	....	.40- .60	......	....
	....	NE 9640	.38-.43	1.20-1.50	.040	.040	.40-.60	....	.40- .60	......	....
	....	NE 9642	.40-.45	1.30-1.60	.040	.040	.40-.60	....	.40- .60	......	....
	....	NE 9645	.43-.48	1.30-1.60	.040	.040	.40-.60	....	.40- .60	......	....
	....	NE 9650	.48-.53	1.30-1.60	.040	.040	.40-.60	....	.40- .60	......	....
Chromium Nickel Austenitic Steels*	30615	303	.15 Max.	2.00 Max.	.040	.18-.35	.75 Max.	7.00-10.00	17.00-20.00	.60 Max.	....
	30615‡	303	.15 Max.	2.00 Max.	.12-.17	.040	.75 Max.	7.00-10.00	17.00-20.00	.60 Max.	
	30705§	321, 347	.08 Max.	2.50 Max.	.030	.030	1.50 Max.	8.00 Min.	17.00 Min.	......	....
	30805	316	.10 Max.	2.50 Max.	.030	.030	.75 Max.	10.00-14.00	16.00-18.00	2.00-3.00	....
	30905	304	.08 Max.	2.00 Max.	.030	.030	.75 Max.	8.00-10.00	18.00-20.00	......	....
	30915	302	.08-.15	2.00 Max.	.030	.030	.75 Max.	7.00-10.00	17.00-20.00	......	....
Stainless Chromium Irons*	51210	410	.08-.15	.60 Max.	.030	.030	.50 Max.	....	11.5-13.0	......	....
	51310	414	.08-.15	.60 Max.	.030	.030	.50 Max.	1.25- 2.00	11.5-13.5	......	....
	51335	420	.25-.40	.60 Max.	.030	.030	.50 Max.	....	12.0-14.0	......	....
	X51410	416	.13 Max.	1.20 Max.	.040	.18-.35	.75 Max.	....	12.0-14.0	.60 Max.	....
	51710	430	.12 Max.	.60 Max.	.030	.030	.50 Max.	....	16.0-18.0	......	....

*Subject to early revision. †Also contains Vanadium .15 per cent min. ‡Also contains Selenium .15-.35 per cent. §Also contains Titanium .40 per cent min. or Columbium .70 per cent min. AISI denotes American Iron and Steel Institute. Prefix A denotes an open-hearth alloy steel. Prefix B denotes an acid bessemer steel. Prefix C denotes an open-hearth carbon steel. Prefix E denotes an electric furnace steel. Prefix NE denotes a national emergency steel.

Plastics and Other Nonmetallics Listed by Tradenames

(For listing by producing companies, and complete street addresses, see Page 162)



A

1 - 3 - - - - - - - -

ACADIA—Western Felt Works, Chicago. Synthetic rubber in sheet form or for molding, cutting or extruding into parts; abrasion-resistant; corrosion-resistant; flexible; tensile strength, 1000-4000 lb. per sq. in.; heat resistance, 350-400 degrees Fahr.; low moisture absorption; nonflammable; shatterproof; specific gravity, 1-1.75; used for gasketing, sealing, cushioning in applications where corrosion and aging are encountered.

See advertisements, Pages 183, 189

1 - - - - - - 7 - - 10

ACE—American Hard Rubber Co., New York. Hard rubber; thermosetting; furnished in sheets, rods or tubes; may be machined, molded or stamped into part; corrosion-resistant; low moisture absorption; high polish; tensile strength 4000-10,000 lb. per sq. in.; heat resistance 140-190 degrees Fahr.; dielectric strength 450-550 volts per mil.; nonflammable. Uses include handles, caster wheels and special molded parts.

1 - 3 - - - - - - - -

AEROLITE—Pittsburgh Plate Glass Co., Pittsburgh. Laminated thin, window glass with Vinal plastic binder, furnished in flat and bent sheets; abrasion resistance, high; heat-resistant up to 160 degrees Fahr.; flexibility, low; moisture absorption, low; nonflammable; shatterproof; transparent; can be highly polished; for nonshatterable windows where low weight is important.

1 2 - - - - 6 - - - - -

AERTITE—Johns-Manville, New York, Rubbery, asphaltic-asbestos base; furnished in soft plastic form; corrosion-resistant, heat-resistant; nonflammable. Used on mechanical equipment to prevent air infiltration.

1 - - - - - - - - - - 10

AMBERLITE—Resinous Products & Chemical Co., Philadelphia. A synthetic resin (adhesive) phenolic resin; furnished in powder form; has low moisture absorption, high density; used in manufacture of waterproof plywood for aircraft and marine use.

1 - - 4 - 6 - - - - -

AMERICAN FELT—American Felt Co., Glenville, Conn. Felt material furnished in sheet, rods or tubes; for machining, stamping and extruding into parts. Abrasion resistance for certain felts is low, while for others high; resists corrosion caused by neutral conditions; heat resistant to 280 degrees Fahr.; flexibility, low, medium or high (as specified); moisture absorption, also is specified; produced in any color; for oil retaining, dust excluding, filtering and vibration dampening.

See advertisement, Page 181

1 2 - 4 - - - - - - -

AMERICAN PLYWOOD—American Plywood Corp., New London, Wis. Phenolic urea plywood, furnished in sheet and laminated form; for machining into parts. Abrasion resistance, medium; heat resistant to 300 degrees Fahr.; flexibility, high; tensile strength, ult., 12,000 lb. per sq. in.; moisture absorption, medium; inflammable; shatterproof; opaque; can be highly polished.

1 2 - - - - - - - - -

AMERIPOL—Miller Rubber Industrial Products Div., Akron, O. Oil-resisting and heat-resisting synthetic rubber; compounded and vulcanized to give wide range of properties. Tensile strength, approximately 4000 lb. per sq. in. In uncompounded form, has specific gravity of 1. Used for grease seals, packing rings, grommets and washers.

See advertisement, Page 185

1 - - - - - - - - - -

ARMSTRONG—Armstrong Cork Co., Lancaster, Pa. Compositions of cork and various synthetic rubber-like materials. Two dozen types, having a wide range of physical properties; furnished in roll, sheet, cut gasket, molded, and extruded forms. Impervious to liquids and gases; highly resistant to deterioration by oils, solvents and most other liquids, gases, corona and weather; high and low coefficients of friction, high and low degrees of compressibility, lateral flow, etc.; available to meet specific requirements. Used as gaskets, packings, washers, valve disks, feed rolls, polishing wheels, airplane walkways, diaphragms, friction and vibration pads, etc.

See advertisement Page 173

B

1 2 3 4 5 6 - 8 9 10

BAKELITE—Bakelite Corp., New York.

1 - - - - - 6 - - - - 10

Phenolic plastics, general purpose; thermosetting; furnished in powder and blanks for plastic molding; corrosion-resistant, dielectric strength 300-500 volts per mil.; nonflammable; tensile strength 6000-11,000 lb. per sq. in.; low thermal conductivity; available in colors; takes high polish; low moisture absorption; nonflammable.

1 2 - - - - - - - - 10

Phenolic plastics, mineral filled. Similar to above but has high heat resistance, low moisture absorption; and is nonflammable.

1 - 3 - 5 - - - - - -

Phenolic plastics, fabric-filled. Similar to general purpose phenolic plastics but are much higher in impact resistance; abrasion resistance; dielectric strength 300-400 volts per mil. Used for gears, bushings, bearings and heavy-duty parts.

1 - - - 5 - - 8 - -

Urea plastics. Thermosetting; furnished in powder form for plastic molding; specific gravity 1.47-1.52; tensile strength 9500-12,000 lb. per sq. in.; dielectric strength 330-375 volts per mil.; nonflammable; takes high polish; available in colors. Used for housings and other parts requiring translucent or opaque colors resistant to fading.

- - 3 - - - - - 8 9 10

Acetate plastics. Thermoplastic; furnished in powder form for plastic molding; in transparent, translucent and opaque effects, in all colors; takes high polish; impact strength .4-1.8 ft. lb.; tensile strength 2500-9500 lb. per sq. in.; suitable for wide variety of mechanical parts requiring brilliant color and high shock resistance.

1 - - - 5 - - - 9 -

Polystyrene plastics. Thermoplastic; furnished in powder form for molding; transparent, translucent and opaque effects, in all colors; takes high polish; nonflammable; low moisture absorption; specific gravity 1.05-1.07; dielectric strength 500-525 volts per mil.; resistivity 10° megohm centimeters; power factor .0002-.0003 from 60 cycles to 50,000 cycles; offers exceptional resistance to acids and alkalis.

1 - - - 5 6 - - - -

Cast resins; available in BT 44, 45, 48, 55 and 58 types; in rods, sheets, tubes and many special types of castings. BT 44, 45 and 55 are opaque, translucent and mottled; corrosion resistant; of high dielectric strength; available in colors; and low moisture absorption; used for radio cabinets, etc. BT 48 and 58 are crystal clear, mottled transparents, and transparent colors of any hue; available as castings including rods, sheets and tubes; highly resistant to acids; used in place of glass and can be readily machined and used for gauges, peep holes, etc.

1 2 3 - - - - - - -

BT 63,000 resin is available in ivory, in rods and many other shapes; used for applications where dimensional stability is required; impact and heat resistant.

1 - 3 4 - - - - - -

BT 61-893; available in plates only; transparent water white; very stable; color-fast; excellent on dimensional stability; used for photoelastic stress study work.

1 - - 4 - - - - - 10

BT 41-001; available in transparent amber castings and sheets made to order; resistant to hydrofluoric acid; used where very high dielectric strength and low moisture absorption properties are required.

BT-48-306; nonstatic, used for instrument windows and comes within Navy Specifications.

See advertisements, Pages 104-105

1 - - - 5 - - 8 - -

BEETLE—Beetleware Division, American Cyanamid Co., New York. Urea-formaldehyde base, thermosetting; furnished in powder or granule for molding purposes; available in colors; translucent; high polish; dielectric strength 385 volts per mil.; tensile strength 5500-7000 lb. per sq. in. Used for housings, cabinets, knobs, dials and insulators.

- 2 - 4 - - - - 9 -

BOOTH FELT—Booth Felt Co. Inc., Brooklyn, N. Y. Wool base felt; furnished in sheets or strips for machining or stamping into parts; heat resistance 400 degrees Fahr.; tensile strength, 5-100 lb. per sq. in.; available in colors and in a variety of types and grades; used for washers, gaskets, grease seals, and pads for insulating machinery or reducing vibration.

C

- - - 4 - 6 - - - 10

CATABOND—Catalin Corp., New York. Phenolic base, thermosetting; furnished in liquid form; excellent abrasion resistance; can be highly polished; dielectric strength, 350-700 volts per mil, ⅛-inch thick; tensile strength, 7000-8000 lb. per sq. in.; heat resistance, 212-300 degrees Fahr.; low moisture absorption; nonflammable; translucent; used for panels, housings, gears, liners, etc.

1 - - - 5 6 - - - -

CATALIN—Catalin Corp., New York. Phenolic base, thermosetting; furnished in sheets, rods or tubes, or special castings; high dielectric strength; nonflammable; low moisture absorption; high tensile and compressive

1—Corrosion resistant | 2—High heat resistant | 3—Impact resistant | 4—High tensile strength | 5—High dielectric strength | 6—Nonflammable | 7—Takes high polish | 8—Translucent | 9—Available in colors | 10—Low moisture absorption

strengths; high abrasion resistance; available in colors; insoluble in ordinary solvents. Used for clock and instrument cases, auto fittings, knobs for electrical appliances, etc.

1 2 - - - 6 - - - -
CELITE—Johns-Manville, New York, Diatomaceous silica material; furnished in powdered, granular and brick forms; resistant to chemical corrosion; heat-resistant; nonflammable. Used for insulation of equipment operating at high temperatures.

- - 3 - - - 7 - 9 -
CELLULOID—Celanese Celluloid Corp., Plastics Div., New York. Cellulose-nitrate base, thermoplastic; furnished in sheets, rods and tubes; used for molding, swedging, veneering, machining or stamping into parts; available in colors; high polish; tensile strength 5000-10,000 lb. per sq. in.; flexible; resistant to corrosion; dielectric strength 600-1200 volts per mil; transparent. Used for instrument dials, tool handles, key buttons, register wheels, etc.

1 - 3 - - - - 8 - -
CEL-O-GLASS—E. I. du Pont de Nemours & Co., Wilmington, Del. Plastic-coated wire mesh which transmits ultra-violet rays; corrosion-resistant; resistant to shock; translucent; flexible; light weight. Used where an opalescent or translucent, flexible material is required.

1 - 3 4 - - - - - -
CELORON—Continental-Diamond Fibre Co., Newark, Del. Resinous base, thermosetting; furnished in molded parts and laminated forms, for machining into parts; corrosion-resistant; resistant to shock; high tensile and dielectric strength; low moisture absorption; high heat resistance and abrasion resistance; takes high polish. Grade C (canvas base) used for heavy-duty gears. Type L (linen base) used for small gears of fine pitch and narrow face, and intricate punchings.

- - 3 4 - - - - - -
CO-RO-LITE—Columbian Rope Co., Auburn, N. Y. Phenolic base resin material, furnished in sheet form for molding into parts. Abrasion resistance, high; heat-resistant up to 350 degrees Fahr.; flexibility, medium; tensile strength, 11,000 lb. per sq. in.; flammable; can be highly polished; opaque; and can be produced in color.

1 - 3 - 5 - - - - -
CRYSTALITE—Rohm & Haas Co., Philadelphia. Acrylic base, thermoplastic; furnished in molding powder for compression and injection molding; corrosion-resistant; resistant to shock; transparent; flexible; specific gravity 1.18; tensile strength 4000-6000 lb. per sq. in.; available in colors and high polish. Used for unbreakable fuel gages, dials and dial covers and moldings of all kinds.
See advertisement, Page 87

D

- - 3 4 5 - - - - -
DENSEWOOD—Densewood Corp., Elkhorn, Wis. A wood-base, thermoplastic material to be machined into parts. Abrasion resistance, medium; heat-resistant to 350 degrees Fahr.; flexibility, low; tensile strength, 18,000 lb. per sq. in.; compressive, 14,400 lb. per sq. in.; moisture absorption, low; nonflammable; specific gravity, 1.15; opaque; can be highly polished. Used for pulleys, rollers, pushbuttons, etc.

- - - 4 5 - - - 9 -
DIAMOND—Continental-Diamond Fibre Co., Newark, Del. Vulcanized fibre, bone-like material; furnished in sheets, rods and tubes, for machining, sawing or punching into parts; high tensile and dielectric strengths; low specific gravity; tough; pliable; impact-resistant; used for insulating members, bobbin heads, etc.

- - - - 5 - - - 9 -
DILECTENE—Continental Diamond Fibre Co., Newark, Del. Insulating material available in two grades:
No. 100; pure aniline-formaldehyde synthetic resin, which contains no cellulosic filling materials; highly resistant to moisture and electrically very stable; specific gravity, 1.21; tensile strength, 10,500 lb. per sq. in.; flexural strength, 20,000 lb. per sq. in.; compression strength, 20,000 lb. per sq. in.; and dielectric strength, 640-650 volts per mil.
No. 160; plasticized grade to fit into picture now occupied by hard rubber, polystyrene, phenolic laminates, mica-resin or mica with inorganic binder combinations, and certain ceramics. Specific gravity, 1.31; tensile strength, 9000 lb. per sq. in.; flexural strength, 16,000 lb. per sq. in.; compression strength, 20 000 lb. per sq. in.; and dielectric strength, 470-480 volts per mil.

- - - 4 5 - - - - 10
DILECTO—Continental-Diamond Fibre Co., Newark, Del. Phenolic base, thermosetting; furnished in laminated sheets, rods and tubes, for machining or stamping into parts; dielectric strength 270-500 volts per mil; low moisture absorption; tensile strength 10,000-25,000 lb. per sq. in.; corrosion-resistant; heat resistance 290 degrees Fahr., available in colors; resistant to shock; takes high polish; impact-resistant; insoluble. Used for electrical, thermal and mechanical insulating parts.

1 - 3 - 5 - - - - -
DUFELT—Felters Co. Inc., Boston. Laminated felt and Neoprene. Various thicknesses and lamination arrangements. Corrosion resistant. Used for washers and strips for oil and grease retention where conditions are too exacting for use of plain felt. Petroleum resistant.
See advertisement, Page 116

1 - 3 - - - 7 - - -
DUOLITE—Pittsburgh Plate Glass Co., Pittsburgh. Laminated window glass with Vinal plastic binder; furnished in flat and bent sheets; abrasion resistance, high; heat resistant to 180 degrees Fahr.; flexibility, low; moisture absorption, low; nonflammable; shatterproof; transparent; for nonshatterable windows which need not be optically perfect.

1 - 3 - - - 7 - - -
DUPLATE—Pittsburgh Plate Glass Co., Pittsburgh. Laminated plate glass and Vinal plastic binder, furnished in flat and bent sheets; abrasion resistance, high; heat resistant to 180 degrees Fahr.; flexibility, low; moisture absorption, low; nonflammable; shatterproof; transparent; for nonshatterable windows.

1 - - - 5 - - - - 10
DUREZ—Durez Plastics & Chemicals Inc., North Tonawanda, N. Y. Phenolic base, thermosetting; powder form, for molding into parts; resistant to corrosion; high polish; low moisture absorption; heat resistance 350-550 degrees Fahr.; tensile strength 4000-7000 lb. per sq. in.; available in colors; shock and abrasion-resistant. Used for housings, handles, bases, knobs, electrical parts, small gears, frames, hoods, etc.

1 - 3 - 5 - - - - -
DURITE—Durite Plastics Inc., Frankford Sta., P. O., Philadelphia. Phenol-furfural and phenol-formaldehyde synthetic resins, heat-setting; available in crushed, pulverized or liquid form, for bonding hot or cold-molding compound, plywood, veneer, cements, abrasive articles, etc.; or in powder form for hot press-molding; possesses high heat and shock resistance; high tensile and dielectric strengths, corrosion resistance, nonflammability and low moisture absorption. Used for cabinets, housings, handles, keys, knobs, automotive ignition, hand wheels, terminals, etc.

E

1 - - - 5 - - - - 10
EBROK—The Richardson Co., Melrose Park, Ill. Acid-resisting bituminous plastic for specific requirements including such parts as battery containers.
See advertisement, Page 91

- 2 - 4 - 6 - - - -
EEL-SLIP—Johns-Manville. New York. Asbestos fiber, graphite and rubber compound; heat-resistant; high tensile strength; nonflammable. Used for bearings, suction box covers, etc.

- - - 4 5 - - - - 10
ETHOCEL—The Dow Chemical Co., Midland, Mich. Plastic granules, thermoplastic; furnished in granular form for injection and extrusion molding; dielectric strength 1500 volts per mil on .010-in. thickness; tensile strength 7000-8500 lb. per sq. in.; heat resistance 130-150 degrees Fahr.; low moisture absorption, good dimensional stability, available in color; specific gravity 1.10-1.25; translucent; opaque; compressive strength 10-12,000 lb. per sq. in. Used for articles when dimensional stability is required, etc. also furnished in sheeting.

F

1 - - - - - 7 - - 10
FARLITE—Farley & Loetscher Mfg. Co., Dubuque, Iowa. Phenolic and urea base, thermosetting; furnished in laminated sheets; for machining and stamping into parts; resistant to corrosion; high polish; low moisture absorption; impact-resistant; available in colors; tensile strength 6000-8000 lb. per sq. in.; dielectric strength 700 volts per mil. Used for sawed or stamped flat parts for light machine members.

1 - - - 5 - 7 - - -
FARLOEX—Farley & Loetscher Mfg. Co., Dubuque, Iowa. Fibrous synthetic core with laminated Bakelite surface, thermosetting; furnished in laminated sheets, for machining into parts; dielectric strength 200 volts per mil; resistant to corrosion; high polish; available in colors; resistant to impact; low moisture absorption; tensile strength 5000-6000 lb. per sq. in.; heat resistant 450 degrees Fahr. phenolic; 370, urea. Used for low voltage insulation with moderate strength.

1 2 - - - 6 - - - -
FEATHERWEIGHT—Keasbey & Mattison Co., Ambler, Pa. Magnesia blocks, pipe covering and cement. Combination of magnesia and asbestos in powder or molded form with exceptionally low thermal conductivity. Used as a thermal insulating material where temperature does not exceed 600 degrees Fahr.

1 - - - 5 - - - 9 -
FELTERS FELT—Felters Co. Inc., Boston. Nonwoven felts to S.A.E. and other specifications. Available either in the piece or cut to customer's requirements. Used for pads, bumpers, antisqueak and rattle parts, filters, polishing roll covering, shaft and bearing seals, etc. Petroleum-resistant.
See advertisement, Page 116

- 2 - 4 - 6 - - - 10
FIBERGLAS—Owens-Corning Fiberglas Corp., Toledo, O. Furnished in flexible semirigid and rigid forms, nonflammable; light in weight; high insulating value; resistant to corrosion; low moisture absorption; for use as thermal insulation temperature ranges up to 1000 degrees Fahr. Also available in other types, as follows:
Dust-stop air filter; fibrous glass for use in air filtration equipment.
- 2 - 4 - - - - - 10
Electrical insulations; fibrous glass used as basic electrical insulation for all types of magnetic equipment; abrasion resistance, medium; corrosion-resistant; heat-resistant to 900 degrees Fahr.; flexibility, high; low moisture absorption and nonflammable.
- 2 - - - 6 - - - 10
TWF wool; glass in sheet form, resists corrosion caused by moisture; flexibility, high; low moisture absorption; nonflammable; for thermal insulating.

1 - - 4 5 - - - - -
FIBESTOS—Monsanto Chemical Co., Plastics Div., Springfield, Mass. Cellulose-acetate; thermoplastic; furnished in sheet, laminated and powder forms or rods and tubes, for molding, machining, stamping or swaging into parts; resistant to corrosion; transparent; available in colors; flexible; tough; high polish; dielectric strength 540-1800 volts per mil; tensile strength 6000-6800 lb. per sq. in. Used for safety glass, and compressible shims, couplings, gaskets, electrically insulated knobs and handles, light diffusing panels, and molded shapes of all descriptions.

- 2 - - - 6 - - - -
FIRECRETE—Johns-Manville, New York. A castable refractory (ceramic); furnished in

1-Corrosion resistant | 2-High heat resistant | 3-Impact resistant | 4-High tensile strength | 5-High dielectric strength | 6-Nonflammable | 7-Takes high polish | 8-Translucent | 9-Available in colors | 10-Low moisture absorption

powder for casting into parts; abrasion resistance, good; heat resistance, 2400 and 2800 degrees Fahr.; specific gravity, 110 lb. per cu. ft.; used for special shapes, door linings and other types of monolithic construction. Material can be quickly cast into any shape.

1 - 3 - - - - - - -
FLEXSEAL—Pittsburgh Plate Glass Co., Pittsburgh. Laminated plate glass with extended Vinal plastic edge, furnished in flat and bent sheets; abrasion resistance, high; heat resistant to 180 degrees Fahr.; flexibility, medium; moisture absorption, low; shatterproof; transparent; can be highly polished; flexible edge simplifies installation; for windows having nonrigid frames or windows requiring an airtight edge seal.

- - 3 4 5 6 7 - - -
FORMICA—Formica Insulation Co., Cincinnati. Resinous base, thermosetting; furnished in laminated form, for machining or stamping into parts; corrosion-resistant; tensile strength is slightly less than cast iron; high dielectric strength; absorbs no oil; changes in dimensions only slightly as the result of moisture absorption. Used for insulating washers and bushings, punched parts in switches, automotive starting systems and all types of heavy-duty gears.

- - 3 4 - - - - - -
Grade C; phenolic laminated fabric; thermosetting; furnished in laminated form and in rods or tubes; can be highly polished; corrosion-resistant to acids and salts, not alkalies; flexible in thin sections; dielectric strength, 200 volts per mil in $\frac{1}{16}$-inch thick; tensile strength, 10,000 lb. per sq. in.; heat resistance, 300 degrees Fahr.; used for silent gears.

- - 3 - - 6 - - - -
Grade MF; aniline-formaldehyde thermosetting material; furnished in rods and laminated sheets, for molding, machining or stamping into parts; corrosion-resistant; heat-resistant to 280 degrees Fahr.; flexibility, medium; tensile strength, 14,000 lb. per sq. in.; compressive, 42,000 lb. per sq. in.; dielectric strength, 450 volts per mil; moisture absorption, low; nonflammable; shatterproof; opaque; for low-power loss insulator, to replace glass and porcelain parts.

- - - - 5 - 7 - - 10
Grade XX; phenolic laminated paper; thermosetting; furnished in laminated form and in rods or tubes; can be highly polished; dielectric strength, 500 volts per mil; tensile strength, 12,000 lb. per sq. in.; heat resistance, 300 degrees Fahr.; available in natural and black; low moisture absorption; used for insulation for electrical equipment.

See advertisement, Page 95

- - - 4 5 - 7 - - -
FRANKLIN — Franklin Fibre-Lamitex Corp., Wilmington, Del. Hard vulcanized fibre; furnished in laminated sheets, rods or tubes; for machining and stamping; dielectric strength 200-400 volts per mil of thickness; tensile strength 12,000-15,000 lb. per sq. in.; specific gravity 1.3-1.46; compressive strength 38,000-42,000 lb. per sq. in.; nonflammable. Used for electrical insulation.

- - - 4 5 - - - - -
FYBEROID — Wilmington Fibre Specialty Co., Wilmington, Del. Paper base; furnished in sheet form, for machining or stamping into parts; dielectric strength 200-400 volts per mil; tensile stength 5000-8000 lb. per sq. in.; flexible; abrasion and corrosion-resistant. Used for insulation on motors, generators, automotive ignition starters, etc.

G

- 2 3 - - - - - - 10
GARIT—Garfield Mfg. Co., Garfield, N. J. Thermosetting, cold-molded plastic; corrosion-resistant; dielectric strength, 50-60 volts per mil; tensile strength, 1200 lb. per sq. in.; heat resistance, 450 degrees Fahr.; moisture absorption, 2.4 per cent; nonflammable; compressive strength, 7500 lb. per sq. in.; used for molded insulation for electrical equipment.

- - - 4 - - - - - -
GASKOFELT — Western Felt Works, Chicago. Compact combination of felt with an oil-resistant rubber compound of great density and high tensile strength. Used for gasketing in connection with oil, steam, hot or cold water; temperatures up to 250 degrees Fahr.; pressures up to 225 lb.

See advertisements, Pages 183, 189

1 - 3 4 - - - - - -
GEMFLEX—Gemloid Corp., Elmhurst, L. I., N. Y. Vinylite tubing and gasketing; thermoplastic material furnished in rods or tubes, for molding into parts; odorless, nontoxic and very slow-burning; exceptional resistance to oil moisture and most chemicals; strong and tough at lower than freezing temperatures; strong resistance to abrasion; high fatigue strength; unusual flexibility; for insulating, gasketing, etc.

1 - - - 5 - - - - -
GEMLOID—Gemloid Corp., Elmhurst, L. I., N. Y. Thermosetting and thermoplastic material, furnished in sheet and laminated form for stamping into parts; abrasion resistance, medium; heat resistance for thermoplastics is 175 degrees Fahr. and for thermosetting type, 400 degrees Fahr.; tensile strength, 4000-6000 lb. per sq. in.; moisture absorption, low; nonflammable; used for replacing metal nameplates.

1 2 - - 5 - - - - -
GUMMON—Garfield Mfg. Co., Garfield, N. J. Black, cold-molded; corrosion and heat-resistant (450 degrees Fahr.); high dielectric strength; high polish; resistant to hot oil. Will not shrink, crack, warp or deteriorate with age. Takes high polish. Used for insulated parts such as wiring devices and other small units.

H

- - - - 5 6 - - - -
HARVEL—Irvington Varnish & Insulator Co., Irvington, N. J. Cold setting phenol-aldehyde synthetic resin cement for cable splices, stop joints and oiltight terminals. Applied as a liquid which polymerizes at ordinary temperatures whether exposed to air or not, into a firm, enduring, infusible insulation. Material is flame-resistant, will not melt or soften after setting, and is not affected by acid and alkali solutions; electrical properties of dielectric strength, dielectric constant and power factor are extremely favorable.

See advertisement, Page 181

- - - - - - - - - 10
HASKELITE — Haskelite Mfg. Corp., Chicago. Plastic-bonded plywood; light weight; high strength; elastic; hard; bendable into desired forms and shapes. Used for airplanes, buses, street cars, railways, radio cabinets and speakers, passenger cars, etc.

1 2 - - - - - - - 10
HEMIT — Garfield Mfg. Co., Garfield, N. J. Cold-molded, gray-white refractory material; corrosion resistant; heat resistance 1100-1500 degrees Fahr.; low moisture absorption when impregnated; high dielectric strength; nonflammable. Used for interior parts of heating devices, or where a molded part must withstand an arc.

- 2 3 4 - - - - - -
HERCULITE—Pittsburgh Plate Glass Co., Pittsburgh. Tempered or heat-treated plate glass, furnished in flat and bent sheets; abrasion resistance, high; heat resistant to 400 degrees Fahr.; flexibility, medium; tensile strength, 30,000 lb. per sq. in.; moisture absorption, low; nonflammable; specific gravity, 2.52; transparent; can be highly polished; for use as windows or any glass application requiring unsual strength.

- 2 - - - 6 - - - -
HY-TEMP—Keasbey & Mattison Co., Ambler, Pa. Diatomaceous earth and asbestos base; combination heat-insulating blocks, cements and pipe covering; furnished in powder or molded form; high heat resistance; low moisture absorption; nonflammable; and low moisture absorption; nonflammable; and low thermal conductivity. Used for thermal insulation up to 1900 degrees Fahr.

1 2 - - - - - - - -
HYCAR—The Hycar Chemical Co., Akron, O. Vulcanizable types of synthetic rubbers of butadiene base furnished in crude sheet form to be compounded into any type of stock desired for further processing by molding, extruding, calendering, etc.

Type O.R.-15 (Oil Resistant); has excellent oil, heat, abrasion and aging resistance; excellent flex life; tensile strength to 4000 lb. per sq. in., with elongation of 600 per cent. Adaptable to temperature range of -50 degrees Fahr. to 300 degrees Fahr.; low moisture absorption; specific gravity, 1.

Type OS-10 (Oil Soluble) designed for electrical insulating applications where resistivities in excess of natural rubber are required. Adaptable to temperature range of —40 degrees Fahr. to 300 degrees Fahr.

Type OS-20 (Oil Soluble) direct replacement for natural rubber in applications where better resistance to heat, aging and abrasion is required.

All types used for gaskets, tubing, vibration insulators, packings, hose, printing rollers and blankets, wire covering and jacketing, and any other general type of application where resilient materials are required. All can be compounded to bonehard (Ebonars) with a 100 degree Fahr higher softening point than obtainable with natural hard rubber. All types also available in latex state for spreading, dipping and coating.

1 2 - - - - - - - -
HYDEN—Parkwood Corp., Wakefield, Mass. Phenolic base thermosetting material; furnished in laminated form to be machined into parts; tensile strength, 57,000 lb. per sq. in.; compressive, 28,000 lb. per sq. in.; moisture absorption, low; nonflammable; specific gravity, 1.28-1.36; can be highly polished, impact resistance, good; used in airplane propellers.

1 - - - - - - - - -
HYFLEX—Irvington Varnish & Insulator Co., Irvington, N. J. An opaque, extruded plastic tubing. Its rubber-like qualities provide unusual elongation. Useful in many places where metal and rubber were formerly utilized. Resists brittleness at temperatures down to —50 degrees Cent. Available in black only. Tensile strength, 3000 lb. per sq. in.: dielectric strength, dry —850 volts per mil; wet —815 volts per mil.

See advertisement, Page 181

I

- - - - 5 6 - - 9 10
INCELOID — American Products Mfg. Co., (Inceloid Co. Inc., subsidiary) New Orleans. Cellulose derivative, thermoplastic; furnished in sheet and laminated form for casting into parts; corrosion and heat-resistant; can be highly polished; flexible; high dielectric strength; low moisture absorption, available in colors; shatterproof. Used for electrical insulation, laminating work, etc.

- - - 4 5 6 - - - -
INDUR—Reilly Tar & Chemical Corp., Indianapolis. Phenolic base, thermosetting; furnished in powder form, for molding into parts; tensile strength 8560 lb. per sq. in.; high dielectric strength; nonflammable; low moisture absorption; high heat resistance; corrosion and abrasion resistant; available in colors; flexibility, medium; specific gravity 1.37±. Used for instruments and machine accessories including insulating panels, knobs and handles, control levers, gears, etc.

- - - 4 5 - - - - 10
INDUR VARNISH — Reilly Tar & Chemical Corp., Indianapolis, Phenolic base, thermosetting; for molding into parts; high dielectric and tensile strengths; nonflammable; transparnt; corrosion and high heat resistant; impact resistant; and low moisture absorption. Used for laminated gears.

1 2 - - - - - - - 10
INSULKOTE — Johns-Manville, New York. Weatherproof coating for use over insulation of ducts and other exposed equipment; corrosion and heat resistant; low moisture absorption.

- - 3 4 - - - - - 10
INSUROK—The Richardson Co., Melrose Park, Ill.

Thermosetting type; furnished in laminated sheets, rods and tubes for machining into parts, or as finished molded parts; corrosion-resistant; low moisture absorption; high tensile strength; resistant to shock; comparatively low specific gravity. Used for gears, bearings, electrical insulation. Available in different grades.

See advertisement, Page 91

1-Corrosion resistant | 2-High heat resistant | 3-Impact resistant | 4-High tensile strength | 5-High dielectric strength | 6-Nonflammable | 7-Takes high polish | 8-Translucent | 9-Available in colors | 10-Low moisture absorption

Thermoplastic type; furnished in molded parts; high dielectric strength; low moisture absorption; high tensile strength; low specific gravity. Available in color.

Translucent type; urea or phenolic base, thermosetting; in laminated sheets and fabricated parts, for instrument dials, etc. Material is translucent, does not support combustion, and has low moisture absorption.

See advertisement, Page 91

1 - - - - - - - - -

IRVINGTON—Irvington Varnish & Insulator Co., Irvington, N. J. Varnished insulations for insulating all types of electrical apparatus.

Varnished cambric and tape; straight and bias-cut in black or yellow; available in .005-.015-inch thicknesses.

Varnished cable cloth; for cable construction; available in .005-.012-inch thicknesses.

Varnished Fiberglas; high heat-resisting; .006-.012-inch thicknesses.

Varnished canvas and duck; very durable insulating material; in .016-.020-inch thicknesses.

Flexible varnished tubing; suitable for applications involving high temperature baking; in A.S.T.M. sizes No. 20 to 1-inch inside diameter; smooth inside and outside surfaces for easy assembly; in red, green, black blue and yellow.

Silk alternates; varnished Nylon, rayon and varnished cotton cloth are alternates for varnished silk and are available in .003-.008-inch thicknesses; straight-cut or bias-cut in black and yellow.

See advertisement, Page 181

1 - - - 5 - - - - -

IRVINGTON Insulating Varnishes — Irvington Varnish & Insulator Co., Irvington, N. J. Divided into two main divisions. Harvel varnish typified by types 512-C and 612-C which are coil impregnating varnishes. Hardening by polymerization instead of by oxidation, they overcome storage losses. In electrical windings, the heat of baking chemically reacts the varnish to an infusible state throughout entire winding, will not throw out of motor armatures operating at high speeds. Cannot form gummy "skins" leaving soft interiors because it does not oxidize. They are high in dielectric strength, noncorrosive, provide exceptional acid, alkali and oil resistance being unaffected by nitric, hydrochloric or sulphuric acid solutions, and are not disintegrated by caustic alkalies or petroleum solvents.

See advertisement, Page 181

- 2 - - 5 - - - 9 -

IRV-O-LITE — Irvington Varnish & Insulator Co., Irvington, N. J. Thermoplastic, furnished in rods or tubes; abrasion resistant; corrosion resistant to 30 per cent acids or alkalis; very flexible; opaque; available in six standard colors; does not support combustion.

- 2 - - - - - - 9 -

Type XTE-30; extruded tubing with outstanding mechanical strength, better tear resistance, greater solvent resistance, heat resistance and more fireproof; has good mechanical, chemical and electrical characteristics; flexible; smooth; and available in colors. Used for electrical appliance, automobile; aircraft and radio parts. Tensile strength, 2150 lb. per sq. in.; dielectric strength, dry—750 volts per mil; wet—350 volts per mil.

Type XTE-100; electrical insulating tubing with all advantages offered by the extrusion process of smooth inside and outside walls, great flexibility and resistance to mechanical wear and chemical deterioration; dielectric strength (dry), 750 volts per mil; tensile strength, 2000 lb. per sq. in.; with high resistance to tear and abrasion. Tensile strength, 3700 lb. per sq. in.

See advertisement, Page 181

1 - - - - - - - - -

IRV-O-SLOT—Irvington Varnish & Insulator Co., Irvington, N. J. Varnished and resin-coated slot insulations; for insulating slots of armatures and stators; standard and thin types for large and small motors.

K, L

1 - 3 - - 6 - - - -

"K" FELT—American Felt Co., Glenville, Conn. Kapok felts to Air Corps Specification 16098, Types I and II. Material is corrosion resistant, impact resistant and nonflammable; for insulating, etc.

See advertisement, Page 181

1 - 3 - - - - - 9 -

KOROSEAL—B. F. Goodrich Co., Akron, O. Synthetic elastic; furnished in various consistencies from jelly to bone-like hardness; corrosion and shock resistant; nonflammable; available in colors. Jelly is used for making molds for plastic casts, but other compounds sold only as finished products. Superior to rubber in flexing, oxidation and penetration of moisture or gases; does not swell in oil. Available in molded and extruded forms; also applied as coating to paper and fabric.

- - - - - - 7 - - -

LAMICOID—Mica Insulator Co., New York. Phenolic and urea base thermosetting material furnished in sheet, rods or tubes, and in laminated form for machining and stamping into parts; can be furnished highly polished or satin can also be buffed to restore polish; not soluble but will disintegrate when used in contact with certain acids and caustics; used for gears, electrical and mechanical insulation and nameplates.

- - - 4 5 - - - - 10

LAMITEX—Franklin Fibre-Lamitex Corp., Wilmington, Del. Phenolic base, thermosetting; furnished in laminated sheets, rods or tubes, for machining and stamping into parts; corrosion resistant; high polish; dielectric strength 500 volts per mil; tensile strength 15,000 lb. per sq. in.; heat resistance 300 degrees Fahr.; low moisture absorption; nonflammable; compressive strength 35,000 lb. per sq. in. Used for electrical insulation.

1 - - - - - - 8 - -

LIBBEY Heat-Absorbing Plate Glass — Libbey Owens Ford Glass Co., Toledo, O. Glass furnished in sheet and laminated form, for casting and machining into parts; abrasion resistance, high; corrosion resistant; heat resistant to 550 degrees Fahr.; flexibility, medium; dielectric strength, .204 kilovolts per mil; tensile strength, 6000-36,000 lb. per sq. in.; compressive, 3000-100,000 lb. per sq. in.; moisture absorption, low; nonflammable, specific gravity, 2.52; transparent; can be highly polished; for use where light transmission or vision is desired with heat insulation.

See advertisement, Page 168

1 - - - - 6 - 8 - -

LIBBEY Rolled Figured and Wired Glass—Blue Ridge Div., Libbey Owens Ford Glass Co., Toledo, O. Glass furnished in sheet form for cutting and bending into parts; abrasion resistance, high; resists corrosion caused by everything except hydrofluoric acid; heat resistant to 130-154 degrees Fahr.; flexibility, low; dielectric strength, 10 kilovolts per mil; tensile strength, 6500 lb. per sq. in.; compressive, 36,000 lb. per one-inch cube; moisture absorption, low; nonflammable; available in color; specific gravity, 2.5; in transparent and translucent types; used for covers and safety guards, utilizing polished wire glass, or tempered glass.

See advertisement, Page 168

- - - - 5 - 7 8 - -

LOF Polished Plate Glass—Libbey Owens Ford Glass Co., Toledo, O. Glass furnished in sheet and laminated form; produced in color; specific gravity, 2.5; in transparent and translucent types; takes high polish; has high dielectric strength; used for viewing windows.

See advertisement, Page 168

- - 3 - - - - - - -

LORD—Lord Mfg. Co., Erie, Pa. Rubber-bonded-to-metal, for a variety of uses including shear-type mountings for vibration isolation. Typical applications include aircraft, automotive, and marine engines; motors, pumps, compressors, general machinery, radio equipment, instruments etc., where vibration is encountered.

See advertisement, Page 109

- - 3 - - - - 8 9 -

LUCITE—E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. Polymethyl-methacrylate base, thermoplastic; furnished in powder or sheets, rods and tubes, for molding and machining into parts; transparent, translucent; high dielectric strength; available in colors; resistant to shock; low moisture absorption; high polish; resistant to corrosion; tensile strength 5800-8000 lb. per sq. in.; heat resistance 150-203 degrees Fahr. Used for panels, knobs, models, safety guards, dials and gage glasses, airplane enclosures and automatic parts.

1 - 3 - 5 - - - 9 10

LUMARITH—Celanese Celluloid Corp., Plastics Div., New York. Two types of cellulose acetate base, thermoplastics.

- - 3 - 5 - - - 9 -

One grade furnished in sheets, powder or rods and tubes; powders for compression, injection and extrusion molding. Available in colors, tensile strength 3000-15,000 lb. per sq. in.; dielectric strength 500-2000 volts per mil; high polish; flexible; resistant to shock and corrosion. Used for instrument dials and housings, radio grills, panels, airplane windshields, handles, knobs, register wheels, key buttons, electrical insulated parts, steering wheels, instrument panel knobs, etc.

1 - - - 5 - - - - -

Another is furnished in sheet and rolls or reels in thicknesses of .0007-0.020, for laminating, swedging, drawing, or stamping into parts; abrasion and corrosion resistant; flexible; dielectric strength 700-2500 volts per mil; tensile strength 4500-11,000 lb. per sq. in.; heat resistant to 275 degrees Fahr.; slow burning to nonflammable; transparent. Used for laminated slot insulation paper for motors, wire insulation, formed insulators, etc.

Aero quality; cellulose-acetate base, specially developed for aircraft use in such applications as windows, cockpit enclosures, antennae housings, etc.; tough; has high clarity and optical uniformity; resistant to sunlight and can be heat-formed into three dimensional shapes without surface impairment. Material is abrasion resistant.

1 - - - 5 - - - - 10

LUSTRON — Monsanto Chemical Co., Plastics Div., Springfield, Mass. Polystyrene; thermoplastic; styrene base; furnished in powder for molding into parts; abrasion resistance fair; can be highly polished; corrosion resistant; dielectric strength 500-700 volts per mil; tensile strength 5500-8500 lb. per sq. in.; low moisture absorption; available in color; specific gravity 1.07; clear to opaque. Used for electrical insulating parts, etc.

1 - - - - 6 7 - - -

LUZERNE HARD RUBBER—The Luzerne Rubber Co., Trenton, N. J. Hard rubber, thermoplastic; furnished in sheets, rods or tubes, for molding and machining into parts; high polish; corrosion resistant to acids and alkalies; dielectric strength 6×10^7 megohms constant at 28.8 degrees Cent.; tensile strength 3500-9000 lb. per sq. in.; heat resistant to 120 degrees Fahr.; available in some colors; specific gravity 1.24; compressive strength 8000-12.000 lb. per sq. in. Used for molded machine parts.

M

- - - 4 5 - - - - 10

MAKALOT—Makalot Corp., Boston. Synthetic resinous base; furnished in powder form and also as varnish and sheet, for molding into parts; high tensile and dielectric strength; low moisture absorption; heat, shock and abrasion resistant; nonflammable; flowing and covering characteristics eliminate sticking troubles.

- - - - - 6 - - - 10

MASONITE — Masonite Corp., Chicago. Exploded wood fiber (lignin plastic); thermosetting, furnished in laminated form to be machined into parts; abrasion resistance, medium; heat resistant to 450 degrees Fahr.; dielectric strength, 220 volts per mil; tensile strength, 7650 lb. per sq. in.; compressive, 26,000 lb. per sq. in.; moisture absorption, low; nonflammable; furnished in dark chocolate brown only; specific gravity, 1.36; opaque; can be highly polished; used in aircraft industry as pressure rings, templates, etc., also in communications field in telephone, radio and telegraph.

- - 3 - 5 6 - - - 10

MELMAC—Plastics Div., American Cyanamid Co., New York.

1—Corrosion resistant
2—High heat resistant
3—Impact resistant
4—High tensile strength
5—High dielectric strength
6—Nonflammable
7—Takes high polish
8—Translucent
9—Available in colors
10—Low moisture absorption

- - - - 5 6 - - - -
M-592; melamine-formaldehyde, thermosetting material for molding into parts; abrasion resistance, high; resists corrosion caused by water or solvents; heat resistant to 300 degrees Fahr.; flexibility, low; dielectric strength, 445 volts per mil; moisture absorption low; opaque; nonflammable; high arc resistance. Used where high arc resistance and high dielectric strength at elevated temperatures are required, such as ignition parts.

- - 3 - - 6 - - - 10
120; melamine-formaldehyde, thermosetting material for molding; abrasion resistance, high; heat resistant to 250 degrees Fahr.; flexibility, low; dielectric strength, 170-300 volts per mil; moisture absorption, low; opaque; produced in black; takes high polish; shatterproof; for parts requiring high flexural strength and dimensional stability.

- 2 - - 5 - - - - 10
MICABOND — Continental-Diamond Fibre Co., Newark, Del. A built-up Mica material; furnished in sheets and tubing, for machining and forming into parts; heat resistant; high dielectric and tensile strength; nonflammable; low moisture absorption. Used for V-rings, washers, segments and various special shapes.

- 2 - - 5 - - - - 10
MICAROK—The Richardson Co., Melrose Park, Ill. Sheet mica furnished in sheets or parts; abrasion and corrosion resistant; flexible to some extent; dielectric strength high; heat resistance, good; low moisture absorption; non-flammable; specific gravity, 2.25-2.65 according to grade; used in electrical applications when heat and arc resistance are factors.

See advertisement, Page 91

1 - - - 5 - - - - 10
MICARTA—Westinghouse Electric & Mfg. Co., Trafford, Pa. Phenolic base, thermosetting; furnished in laminated sheet, rods or tubes; for molding, machining or stamping into parts; also special molded shapes; dielectric strength 50-700 volts per mil depending upon grade; low moisture absorption; resistant to shock, corrosion; high polish; flexible; tensile strength 6000-16,000 lb. per sq. in.; heat resistance 230; nonflammable; specific gravity 1.32-1.8 depending upon grade. Used for bearings, gears, bushings, washers, thermal and electrical insulation and parts exposed to acids, alkalies and common solvents.

- - 3 - - - 7 - - -
MULTIPLATE—Pittsburgh Plate Glass Co., Pittsburgh. Multiple laminated plate glass, Vinal plastic binder; furnished in cut sizes and shapes; abrasion resistance, high; shatterproof; transparent; can be highly polished; stops bullets from .50 caliber machine gun and smaller arms; for protection against high velocity missiles.

- 2 - - 5 - - - - 10
MYCALEX — General Electric Co., Pittsfield, Mass. Ceramic base thermoplastic; furnished in sheet, rods or tubes, or injection molded to specifications; for molding or machining into parts; abrasion resistance, moderate; can be highly polished; corrosion resistant; dielectric strength, 350 volts per mil; tensile strength, 5000-7000 lb. per sq. in.; heat resistance, 600 degrees Fahr.; low moisture absorption; nonflammable; available in gray only; opaque; compressive strength, 22-30,000 lb. per sq. in.; used for electrical insulation, switches, etc.

See advertisement, Page 98

N

1 2 - - - - - 7 - - -
NATIONAL CARBON — National Carbon Co. Inc., Carbon Sales Div., Cleveland. Carbon or graphite in amorphous or graphite form; made in a variety of shapes; molded, extruded or machined into parts. In graphitic form carbon possesses excellent lubricating properties; highly resistant to most acids, alkalies and solvents. Used for sleeve bearings, packings, threaded parts, nozzles for corrosive liquids, pipe fittings, valves, tubes tower sections; etc., for the chemical and process industries.

- - 3 4 5 - - - - -
NATIONAL FIBRE—National Vulvanized Fibre Co., Wilmington, Del. Converted cotton cellulose, chemically pure, tough horn-like material; furnished in hard or flexible form in sheets, rolls, tubes, rods and fabricated shapes; high dielectric and mechanical strengths; resistant to abrasion and shock; easily formed and machined; light in weight. Used for gears, valve disks, gaskets, washers, bobbin hears, electrical insulation etc.

See advertisement, Page 189

- - - 4 5 - - - - 10
NATIONAL SWITCH INSULATION — National Vulcanized Fibre Co., Wilmington, Del. Combination laminated Bakelite core with vulcanized fiber surfaces; available in sheets and fabricated shapes; high tracking (arc) resistance combined with rigidity and minimum warpage; high dielectric and mechanical strengths; low moisture absorption; easily stamped and fabricated. Used in switches to support and insulate current-carrying parts.

See advertisement, Page 189

1 2 - - - 6 - - - -
NEOPRENE— E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. Chloroprene rubber; available as hose, wire, cable, sheets, tank linings, gaskets, packing, tubing, belting, diaphragms, industrial truck tires and molded goods. Used as binder for cork and asbestos. Is employed to impregnate or coat canvas, duck or other fabrics. Strength, abrasion resistance, resilience and elasticity of rubber; resistance to deterioration from contact with oils, greases, gâsoline, heat, chemicals, sunlight and ozone; corrosion-resistant; will not support combustion; low moisture absorption; tensile strength 4000 lb. per sq. in.; available in colors. Used for machine applications where rubber characteristics are required but where the product is to be subjected to deteriorating influences.

1 - 3 - - - - - - 10
NEILLITE—The Waterman Mfg. Co., Watertown, Conn. Phenolic base thermosetting material, furnished in powder form for molding into parts; abrasion resistance, medium; resists corrosion caused by weak acid and alkali; flexibility, 9000 lb. per sq. in.; dielectric strength, 300 volts per mil; tensile strength, 6000 lb. per sq. in.; compressive, 25,000 lb. per sq. in.; moisture absorption, low; nonflammable; available in colors; specific gravity, 1.36; shatterproof; for switch cases, spacers, etc.

1 - - - - - - - - -
NIGRUM—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J. Impregnated hardwood bearings and washers; northern hard maple impregnated with specially prepared lubricant; used in loose pulleys, automotive, textile, foundry equipment, etc.

See advertisement, Page 183

1 - - - - - - - 9 -
NITRON—Monsanto Chemical Co., Plastics Div., Springfield, Mass. Cellulose nitrate; thermoplastic; furnished in sheets, rods and tubes, or in laminated form, for machining, molding, stamping, swedging or blowing (steam) into parts; corrosion resistant; translucent; available in colors; flexible; dielectric strength 750-900 volts per mil; tensile strength 6000-9000 lb. per sq. in.; low moisture absorption. Used for sight glasses, safety handles and structural models for strain study.

1 2 - - - - - - - 10
NYLON—E. I. du Pont de Nemours & Co. Inc., Arlington, N. J. Thermoplastic, furnished as monofilament for cutting into parts; abrasion resistance far superior to hog bristle, tough rather than brittle; resistant to many chemicals; very flexible; dielectric strength, (volts per unit) 5 at 1000 cycles, 20 degrees Cent.; tensile strength, 51,000 lb. per sq. in.; melting point, 264 degrees Cent.; nonflammable; produced in black and white; density, 1.14; translucent; used for brush bristles.

O

- - - 4 5 - - - - 10
OHMOID—Wilmington Fibre Specialty Co., Wilmington, Del. Phenolic base, thermosetting; furnished in laminated sheets, rods and tubes, for machining or stamping into parts; dielectric strength 200-700 volts per mil; moisture absorption 2 per cent; insoluble in ordinary solvents; high polish; corrosion resistant; tensile strength 10-14,000 lb. per sq. in.; heat resistance 250-300 degrees Fahr. Used for electric and mechanical insulation.

1 - - - - - - 7 - 9 .
OPALON—Monsanto Chemical Co., Plastics Div., Springfield, Mass. Cast phenolic; thermosetting; furnished in sheets, rods and tubes, or laminated form; for casting and machining into parts; translucent; dielectric strength 250-700 volts per mil; corrosion resistant; tensile strength 6000-11,000 lb. per sq. in.; high polish; moisture absorption .05-.5 per cent; available in colors. Used for safety shields, clock and radio cases, electrically insulated knobs and handles and structural models for strain study, and decorative trim.

P

1 - - 4 5 - - - - .
PANELYTE—The Panelyte Div., St. Regis Paper Co., New York. Laminated phenolic paper or fabric base, with surface of urea-formaldehyde type in colored grades; supplied in sheet, strips, rod, tube and molded form; also fabricated to size; good mechanical strength; resistant to acids and alkalies; low moisture absorption; lightweight; specific gravity 1.38. Used for refrigerator door panels, breaker strips, radio and electrical insulation, gears, pinions and structural parts; also in decorative grades for table tops, panels, etc.

- - 3 4 5 - - - - -
PEERLESS — National Vulcanized Fibre Co., Wilmington, Del. Converted cotton cellulose, chemically pure, fish paper insulation; furnished in sheets and rolls; high dielectric strength combined with toughness, springiness and good bending properties. Used extensively for generator and motor insulation and various other electrical applications.

See advertisement Page 189

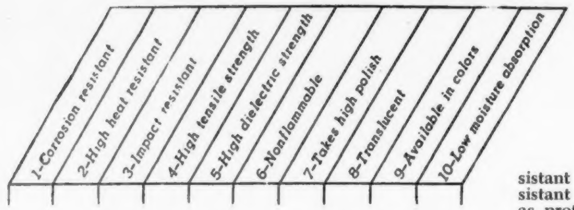
1 - 3 - 5 - - - - -
PENN Vulcanized Fibre—Penn Fibre & Specialty Co., Philadelphia. Paper base material furnished in sheet and rods or tubes, for machining or stamping into parts; abrasion resistance, low; resists corrosion caused by oils and grease; flexibility, low, and high when treated with glycerine; tensile strength, 6500-8500 lb. per sq. in.; compressive, 30-20.000 lb. per sq. in.; nonflammable; available in red, gray, white and black olive; shatterproof; specific gravity, 1.36-1.4; corrosion-resistant; for insulation, special gaskets, washers, special parts, dust guards, pulleys, gears, etc.

1 - 3 - 5 - - - - -
PHENOL FIBRE—Penn Fibre & Specialty Co., Philadelphia. Phenolic base thermosetting material; furnished in sheets, laminated form, and in rods or tubes for machining and stamping into parts; abrasion resistance, high; resists corrosion caused by air, water, oils, light forms of acids; heat resistant to 600 degrees Fahr.; flexibility, low; dielectric strength, 500 volts per mil; tensile strength, 8-12,000 lb. per sq. in.; compressive, 20-35,000 lb. per sq. in.; moisture absorption, low; nonflammable; shatterproof; available in natural, brown and black; specific gravity, 1.4; can be highly polished; for gears, bearings, washers, gaskets, special parts, insulation, pulleys, etc.

1 - - - 5 - - - - 10
PHENOLITE—National Vulcanized Fibre Co., Wilmington, Del. Laminated Bakelite; furnished with base of paper, cloth or asbestos; in sheets, rods, tubes and fabricated shapes; also laminated with rubber sheet; high dielectric and mechanical strengths; low moisture absorption; heat-resistant; infusible; resistant to acids, solvents and oils; high resistance to wear and impact; machinable. Used in electrical, mechanical and chemical applications for silent gears, bearings, bushings, washers, valve disks, terminal strips, etc.

See advertisement, Page 189

- - - 4 - - - 8 9 -
PLASKON—Plaskon Co. Inc., Toledo, O. Urea formaldehyde base, thermosetting; furnished in powder form, for molding into parts; translucent; tensile strength 8000-13,000 lb. per sq. in.; available in colors; corrosion resistant; high polish; dielectric strength 500-700 volts per mil (60 cycles); heat resist-



ance 175 degrees Fahr.; resistant to shock; low moisture absorption. Used for housings, trim, knobs, dials, etc.
Company also is offering urea waterproof adhesives, of both the cold-setting and hot-setting types.

\- - 3 - - - - - 8 9 -
PLASTACELE—E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. Cellulose-acetate base, thermoplastic; furnished in powder, sheets, rods and tubes, for machining and molding into parts; available in colors; transparent; resistant to shock; high polish; corrosion resistant; flexible; dielectric strength 700-1000 volts per mil; tensile strength 3000-8000 lb. per sq. in.; heat resistance 185-250 degrees Fahr. Used for machine guards, models, control panels, dials, knobs, steering wheels, safety glass screens, etc.

1 - - - - - - - - - -
PLASTILIN—M. A. Linsky Co., Los Angeles, Calif. Cellulose base, thermoplastic; furnished in rods or tubes; machined and stamped into parts; used for oil lines, tubes, handles, etc.

1 - 3 - 5 - - - - - -
PLEXIGLAS—Rohm & Haas Co., Philadelphia. Acrylic base, thermoplastic; furnished in sheets and rods; corrosion and shock resistant; transparent; flexible; specific gravity 1.18; tensile strength 7000-9000 lb. per sq. in.; available in colors; high polish. Used for unbreakable inspection windows, dial covers, etc.
See advertisement, Page 87

\- - - - - - - - - - 10
PLYMETL—Haskelite Mfg. Co., Chicago. Plastic-bonded plywood, sheet metal bonded to one or both faces; has stiffness, rigidity; lightweight; metal on both faces insuring freedom from warpage. Types available for different purposes are galvannealed steel, stainless steel, aluminum, copper, chrome zinc, chrome steel, porcelain, etc. Used for applications in the automotive and aircraft fields.

1 - - - - - 6 - 8 - -
POLAROID — The Polaroid Corp., Cambridge, Mass. Light-polarizing glass and film. Principal property is 99.5 per cent polarization of transmitted light, uniformly over large area. Used for camera filters, polarizing attachments for microscopes, polarimeters, and other scientific instruments. Also for polariscopes to determine strain, three-dimensional motion picture apparatus, glareless auto headlights, nonpolarizing colored filters, etc.

1 - - - - 5 - - - - - 10
PREGWOOD—Formica Insulation Co., Cincinnati. Phenolic, impregnated, laminated, densified wood; thermosetting; for machining and pressing; abrasion resistance, high; heat resistant to 175 degrees Fahr.; flexibility, medium; dielectric strength, 200 volts per mil; tensile strength, 30,000 lb. per sq. in.; compressive, 20,000 lb. per sq. in.; moisture absorption, low; inflammable; shatterproof; opaque; can be highly polished; for use as switch gear, instrument plates, fan and propeller blades.
See advertisement, Page 95

1 - - - - 5 - - - - - 10
PRESTITE—Westinghouse Electric & Mfg. Co., Derry, Pa. Ceramic base material furnished in rods or tubes for molding into parts; abrasion resistance, high; resists corrosion caused by everything except hydrofluoric acid; heat resistant to 1450 degrees Fahr.; dielectric strength, 340 volts per mil; tensile strength, 5000 lb. per sq. in.; compressive, 48,000 lb. per sq. in.; no moisture absorption; nonflammable; available in any ceramic glaze; specific gravity, 2.4; opaque; for some die and sand castings, and as a substitute for phenolic plastics.

\- - - 4 - - - - 8 - -
PVA—E. I. du Pont de Nemours & Co., Wilmington, Del. Thermoplastic, polyvinyl alcohol; furnished in powder form for molding and casting; highly flexible; low dielectric strength; heat resistance up to 212 degrees Fahr.; takes color; shatterproof; specific gravity 1.3 powder; translucent; resistant to organic solvents. Used for oil resistant gaskets, tubes, rollers, etc., as well as protective coatings on metal parts.

\- - 3 - - - - - 8 9 -
PYRALIN—E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. Nitrocellulose base, thermoplastic; furnished in sheets, rods and tubes, for machining into parts; transparent; available in colors; shock and corrosion resistant; high polish; flexible; dielectric strength 300-750 volts per mil; tensile strength 5000-10,000 lb. per sq. in. Used for handles, gage glasses, instrument covers, models, safety glass screens, etc.

1 - - - - 5 - - - - - 10
PYROFLEX — Maurice A. Knight, Akron, O. Depolymerized colloidal resin base, thermoplastic; furnished in lump or sheet form; applied by dipping or flame cementing sheets to parts; corrosion resistant; high dielectric strength; low moisture absorption. Good bonding material where temperatures are not too high.

\- 2 - - 5 6 - - - - -
PYROPLAX — Cutler-Hammer Inc., Milwaukee. Asbestos base; furnished in cold-molded pieces; heat resistance 800-1000 degrees Fahr.; nonflammable; dielectric strength 40 volts per mil; resistant to corrosion and abrasion. Used for machine parts where resistance to high temperature is needed.

1 - - - - - - 7 - 9 -
PYREX—Corning Glass Works, Corning, N. Y. Glass products such as tubing, cylinders, sheets, molded parts, etc., covering a wide range of chemical, physical and optical properties such as heat resistance, low or high thermal conductivity, low or high coefficient of expansion, excellent corrosion resistance; no appreciable moisture absorption, nonflammability, ability to bond to metal. Over 250 glasses regularly melted. Specific properties of typical product, PYREX brand piping, as follows: Linear coefficient of expansion .0000018 in. per deg. Fahr. between 66-660 degrees Fahr. Thermal conductibity 8.1 B.t.u./sq. ft. /hr./in./deg. Fahr. at 77 degrees Fahr. Tensile strength 6000-10,000 lb. per sq. in.; dielectric strength, very high.

R

1 - - - - 5 - - - - - 10
RESILON—The United States Stoneware Co., Akron, O. Resinous thermoplastic; furnished in sheets and lumps to be molded and cast into machine parts; corrosion resistant; flexible; high dielectric strength. Used for lining parts to resist corrosive attack.
See advertisement, Page 113

\- 2 - 4 - 6 - - - - -
RESINOUS — Monsanto Chemical Co., Plastics Division, Springfield, Mass. Phenolic molding compounds, in standard and special formulas, thermosetting; heat-resistant; specific gravity 1.44; flexural strength 9200 lbs. per sq. in.; tensile strength 6800 lb. per sq. in.; impact strength 2.5 ft. lb. per sq. in.; water absorption .63 per cent by weight. Used in electrical equipment large housings, radio cabinets, etc. This tradename also refers to phenolic impregnating and treating resins.

1 - - - - - - - - - -
RESISTOFELT—Western Felt Works, Chicago. A lamination of high-grade wool felt and Neoprene. Used on revolving shafts; the felt lubricates the shaft and prevents entrance of dust; the Neoprene prevents passage of oil.
See advertisements, Pages 183, 189

1 - 3 4 - - - - - - -
RESISTOFLEX—Resistoflex Corp., Belleville, N. J. Synthetic resin base, thermoplastic, furnished in sheet and laminated form, and in rods or tubes for molding or extruding; abrasion resistance, high; resists corrosion caused by oils, gasoline, and organic solvents; heat resistant to 275 degrees Fahr.; flexibility, high; dielectric strength, 10.7 volts per mil; tensile strength, 5236 lb. per sq. in.; moisture absorption, medium; available in color; shatterproof; specific gravity, 1.259; transparent; for diaphragms, gaskets, oil hydraulic and lubricating hose assemblies.

\- - 3 4 - - - - - - -
RESNPREST—Plylock Corp., subsidiary of M & M Wood Working Co., Portland, Ore. Phenol-formaldehyde bonded plywood; thermosetting; strong by unit weight; panel ¼-1⅛ inch thick and 12-in. sq. weighs approximately 12 oz., thicker panels can be furnished if desired, widths to 72 inches (sanded) or 96 inches (unsanded); lengths to 144 inches; special scarfed panels to 36 ft.; supports over 400 lb. Cross-ply construction of material makes it splitproof and nails and screws can be fastened to very edge with safety. Resists heat and cold; and has low moisture absorption. Used wherever rigidity and lightweight is needed.

1 - - - - 5 - - - - - 10
RUB-EROK—The Richardson Co., Melrose Park, Ill. Special rubber furnished in sheet form; corrosion resistant; high dielectric strength; low moisture absorption; low loss factor. Used for electrical insulation.
See advertisement, Page 91

1 - - - - 5 - - - - - 10
RUB-TEX—The Richardson Co., Melrose Park, Ill. Hard rubber molded into parts, particularly desirable for electrical, heat and cold insulation; for industrial uses.
See advertisement, Page 91

1 - 3 - - - - - - - -
RYERTEX—Joseph T. Ryerson & Son Inc., Chicago. A nonmetallic bearing material designed for use with water lubrication primarily; high shock resistance; suitable for bearing loads to 5000 lb. per sq. in.; resistant to acids and mild alkalies.

S

SAFLEX—Monsanto Chemical Co., Plastics Division, Springfield, Mass. Polyvinyl acetal thermoplastic sheet material, used as an interlayer in laminated safety glass; extremely tough from temperatures below zero to over 120 degrees Fahr. Has great flexibility and rubberiness.

\- - - - - - - - 8 - 10
SAFETEE GLASS—Safetee Glass Co., Philadelphia. Glass and plastic base, furnished in laminated sheet form to be bent, cut and ground; abrasion resistance, medium; resists corrosion caused by most acids; heat resistant to 140 degrees Fahr.; flexibility, low; moisture absorption, low; nonflammable; available in color; shatterproof; furnished in transparent, translucent and opaque types; can be highly polished; used for machine guards, etc.

\- - - - 5 6 7 - - -
SARAN—The Dow Chemical Co., Midland, Mich. and licensees. Crystalline, thermoplastic, fibrous, aliphatic chloride, polymeric base; furnished in special extruded and molded fabricated forms; corrosion resistant; very tough and flexible; tensile strength up to 50,000 lb. per sq. in. (extruded); no moisture absorption; abrasion resistant; high polish; high dielectric strength; shatterproof; nonflammable, available in color; transparent to opaque; used for moldings, gaskets, packing, tubing, belting, etc.

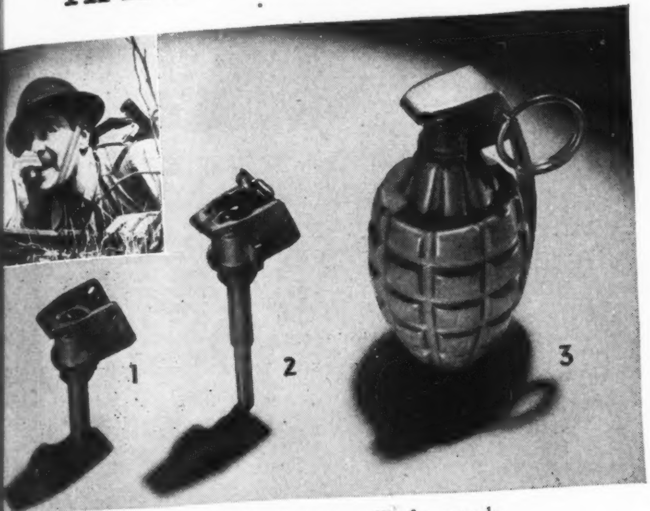
1 2 3 - - - - - - - -
SEYBOLITE—Westport Products Co. Inc., Westport, Conn. A fibrous thermosetting material furnished in sheets, rods or tubes, shredded and laminated form for molding, machining or stamping into parts, in the following types:

Fiber-graphite; abrasion resistance, medium; resists corrosion caused by alkali, acids, moisture and electrolysis; heat resistant to 400 degrees Fahr.; flexibility, low; tensile strength, 17,000 lb. per sq. in.; compressive, 45,000 lb. per sq. in.; moisture absorption, very low; furnished in black only; shatterproof; opaque; nonflammable; for bearings, rollers, tables for machines, base plates for electrotypes in printing, tubing, propellers for aircraft, etc.

Fiber-mineral; molded products as well as panels in nonlaminated and laminated forms; highly compact, hard and durable; specific gravity, 1.65; moisture absorption, very low; nonsplintering under gun fire; fireproof; for fire walls for aircraft engines, bulkheads in ships, partitions in aircraft in electrical devices and switchboards, shells for oil and fuel tanks in aircraft, ships and diesel-operated vehicles, etc.

Fiber-asbestos; produced in thin panel form for laminating on one surface or both of fiber-graphite type for total fireproofing and electrical nonconductance.

IE CAST BOUCHONS FOR HAND GRENADES



The bouchon is "the business end" of a grenade.

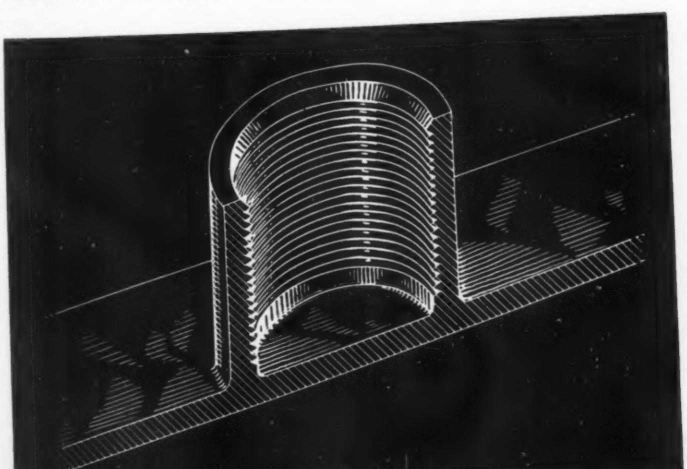
The well-known fragmentation "pineapples" which served our fighting men so well in World War I are equipped, in this war, with ZINC Alloy Die Cast bouchons. This part is particularly well adapted to die casting production because in its detail it constitutes a rather tricky design and, as a die casting, it can be turned out at high speed with practically no machining.

The three steps in the above illustration show (1) the die cast bouchon (2) the bouchon with the booster assembled at the bottom and with the spring firing cap at the top (3) a complete grenade with the release handle and the release ring-pin assembled to the bouchon.

As shown in the inset, the soldier first removes the pin by pulling the ring (in this case with his teeth). This permits the release handle to fly off when the grenade is thrown, springing the firing cap to its charge in the bouchon and thence through the booster to the deadly T.N.T.

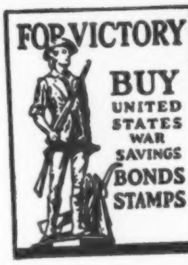
TAPPED BOSSES PROVIDE STRENGTH

In designing a part for production by die casting it should be remembered that tapped bosses are stronger than threaded studs



Tapped bosses are always preferable, and often as economical as threaded studs.

THE New Jersey zinc ALLOY POT



A publication issued for many years by THE NEW JERSEY ZINC COMPANY to report on trends and accomplishments in the field of die castings. Title Reg. U. S. Pat. Off.

MACHINE DESIGN MAGAZINE EDITION

(because external threads cause a notch effect in case of shock loads).

With tapped bosses, however, the precaution must be taken to allow 1/8" at the bottom for chip clearance (see drawing). Failure to provide this clearance in any one boss may add as much as 5% to the cost of the casting, through frequent tap breakage. In addition, a tapped hole should be counter sunk 1/32" larger than the thread for ease of tapping an assembly.

For other hints on good die casting design practice, write to us—on your company letterhead—for a copy of the booklet "Designing for Die Casting."

ZINC ALLOY DIE CASTINGS VS. SAND CASTINGS

In the redesigning of many products, die castings have been adopted to serve where sand castings were previously employed. The reason for this conversion is usually one of simple arithmetic.

Shown below are eight sand-casting-to-die-casting conversions of parts for a navigation training device used in the aviation field. The sand castings, at the background in each case, cost $8.44 for a set of eight. The ZINC Alloy Die Castings, foreground, cost $3.43 a set. In addition, it cost $33.64 to machine the sand castings and only $14.15 to machine the die castings. Thus the total saving on the redesign of the eight castings effected a total saving of $24.50 a set.

Design complexity was achieved by die casting, largely eliminating machining.

THE NEW JERSEY ZINC COMPANY 160 FRONT ST., NEW YORK CITY

HORSE HEAD SPECIAL (99.99 + % Uniform Quality) ZINC

1—Corrosion resistant | 2—High heat resistant | 3—Impact resistant | 4—High tensile strength | 5—High dielectric strength | 6—Nonflammable | 7—Takes high polish | 8—Translucent | 9—Available in colors | 10—Low moisture absorption

\- 2 - - - - - - - - - -
SIRVENE—Chicago Rawhide Mfg. Co., Chicago. Synthetic rubber compounds molded into parts; resistant to oils and heat, oxidation and weather. Used for sealing oils and greases, packings, gaskets, covers and special parts.

\- 2 - - - - - - - - - -
SIRVIS—Chicago Rawhide Mfg. Co., Chicago. Special tanned abrasive and heat-resisting leather. Used for all types of packings, gaskets and mechanical leather parts.

1 - - - - 5 - - - - - -
SPAULDING ARMITE — Spaulding Fibre Co. Inc., Tonawanda, N. Y. Hard vulcanized fibrous material (fish paper); sheets and rolls for stamping or forming into parts; flexible; dielectric strength 200-550 lb. per sq. in.; abrasion and corrosion resistant; tensile strength 9000-15,000 lb. per sq. in.; available in colors; high polish.

\- - - - 4 5 - - - - 9 -
SPAULDING FIBRE—Spaulding Fibre Co. Inc., Tonawanda, N. Y. Hard vulcanized fibrous material; sheets, rods and tubes, for machining, stamping or forming into parts; dielectric strength 150-400 volts per mil; tensile strength 9000-15,000 lb. per sq. in.; available in colors; resistant to shock. Used for mechanical applications where toughness, lightweight and machining and forming properties are essential.

1 - - - - 5 - - - - - 10
SPAULDITE—Spaulding Fibre Co. Inc., Tonawanda, N. Y. Phenolic base, thermosetting; furnished in laminated sheets, rods and tubes for machining or stamping into parts; dielectric strength 700 volts per mil; low moisture absorption; high polish; corrosion and heat resistant (220 degrees Fahr.); resistant to shock. Used for electrical insulation and where resistance to moisture and chemicals, appearance and permanence are essential.

\- 2 - - - 5 - - - - - -
SPAULDO—Spaulding Fibre Co. Inc., Tonawanda, N. Y. Fibrous material; furnished in sheet form for machining or stamping into parts; flexible; dielectric strength 300 volts per mil; heat resistance 220 degrees Fahr.; high polish; corrosion resistant; tensile strength 5000-16,000 lb. per sq. in.; resistant to shock. Used for applications where flexibility and toughness in both grain directions are essential.

1 - - - - - - - - - 9 10
STYRON NA, LA, GA and CA—Dow Chemical Co., Midland, Mich. Thermoplastic; furnished in granules for molding; abrasion-resistant, high clarity; corrosion resistant; dielectric strength 5000 volts per mil at 1 mil, 500 volts per mil at 125 mil; tensile strength, ult., to 10,000 lb. per sq. in.; low moisture absorption; low flammability; available in color; transparent. Used for insulators, decorative articles, structural parts, general injection molding, etc.

\- - 3 4 - - - - - - -
SWEET HOME BRAND—Am-mex Sales Co. Inc., Buffalo. Phenolic resin-bonded, thermosetting plywood, machined into parts. Used for aircraft cabinets, instrument panels, bases, bodies, boats, etc.

1 - - - 5 - 7 - - 10
SYNTHANE—Synthane Corp., Oaks, Pa.

1 - - - - - - - - - - 10
Grades C and C-CR; Phenolic; thermosetting; furnished in laminated sheets, and rods or tubes for machining, stamping and sawing into parts; abrasion and corrosion-resistant; dielectric strength 200 volts per mil (1/16-inch thickness); tensile strength 9500 lb. per sq. in.; heat resistance 250 degrees Fahr.; low moisture absorption; nonflammable; shatterproof; specific gravity 1.36. Used for gears, cams, structural parts, rollers, valve disks, corrosion resistant piping, gaskets and thrust washers.

\- - - - 5 - 7 - - 10
Grade XX; Phenolic; thermosetting; furnished in laminated sheets, rods or tubes for machining, stamping and sawing into parts; abrasion and corrosion-resistant; dielectric strength 700 volts per mil; tensile strength 8000 lb. per sq. in.; heat resistance 250-300 degrees Fahr.; low moisture absorption; shatterproof; specific gravity 1.36. Used for radio panels, coil forms, switch and relay parts, lead-in bushings, terminal blocks and insulating parts.

\- - - - 5 - - - - - 10
Grade XP; Phenolic; thermosetting; furnished in laminated sheets for machining, stamping and sawing into parts; abrasion-resistant not as corrosion-resistant as foregoing grades; dielectric strength 700 volts per mil; tensile strength 8000 lb. per sq. in.; heat resistance 250 degrees Fahr.; used for radio switch part punchings, condenser stator brackets, washers and relay insulation punchings.

T

\- - - - 5 - 7 - 9 -
TAYLOR FIBRE—Taylor Fibre Co., Norristown, Pa. Phenolic base, thermosetting; furnished in laminated sheet, rods or tubes for machining into parts; high polish; flexural strength 12,000-16,000 lb. per sq. in.; dielectric strength 500 volts per mil; tensile strength 5000-9000 lb. per sq. in.; heat resistance 300 deg. Fahr.; low moisture absorption; available in colors; impact resistant; brinell hardness 35-45. Used for gears, and insulating and binding material against moderate temperatures.
See advertisement, Page 183

1 - - - 4 5 - - - - - -
TEGIT—Garfield Mfg. Co., Garfield, N. J. Tan colored, cold-molded plastic; corrosion resistant; high dielectric strength; low moisture absorption; heat resistance 300 degrees Fahr.; impact resistant; resists hot oil, boiling water and ordinary chemicals; will not shrink, crack, warp or deteriorate with age. Used for wiring devices and small insulated parts.

1 - - - - - - - - - - 10
TEGO—Resinous Products & Chemical Co., Philadelphia. A synthetic resin (adhesive) phenolic resin film, dry sheet. Has low moisture absorption, high density; used in manufacture of waterproof plywood for aircraft and marine use.

\- - 3 - - - - 7 - 9 -
TENITE—Tennessee Eastman Corp., Kingsport, Tenn.

I; cellulose-acetate base, thermoplastic; furnished in granular and molding sheet form; available in clear transparent and colors, plain, variegated, translucent and opaque; high impact strength; high polish. Used for compression and injection molding decorative and industrial products, also extruded in form of strips, rods and tubes.

II; cellulose-acetate butyrate base, thermoplastic; furnished in granular and molding sheet form; has greater dimensional stability than cellulose acetate plastic because of lower moisture absorption; contains less plasticizer than cellulose acetate plastic and the plasticizer used has greater retentivity; available in clear transparent and colors; plain, variegated, translucent and opaque; high impact strength; high polish. Used for compression and injection molding of decorative and industrial products, also extruded in form of strips, rods and tubes.

1 - - - - - - - - - - 10
TENSILASTIC—American Wringer Co., Woonsocket, R. I. Rubber rolls. Available in any size from ½-inch long and ½-inch in diameter to 300 inches long and 44 inches in diameter; any density from dead hard to very soft; compounded to meet mechanical and chemical requirements.

1 - 3 4 - - - - - - -
TEXTOLITE—General Electric Co., Plastics Dept., Pittsfield, Mass. Phenolic, urea, cellulose bases, thermosetting and thermoplastic materials; compression, injection and transfer molded, laminated, molded laminated, sheets, rods, tubes, bearings, fabricated parts; abrasion and corrosion resistant; tensile strength, 3500-20,000 lb. per sq. in.; dielectric strength 60-1000 volts per mil; heat resistant 140-450 degrees Fahr; resistant to shock; flexible in some grades; available in color; takes high polish; translucent in some grades; specific gravity 1.07-2.03. Used for electrical or thermal insulation, structural parts, gears, cams, bearings, housings, knobs, decorative parts, etc.

1 2 - 4 - - - - - - -
Cold Molded—Two types: nonrefractory material containing asphalt as a binder and asbestos as a filler and refractory containing cement and drying oils as a binder with an asbestos filler; cold molded at room temperatures and heat treated for strength and toughness; corrosion-resistant; heat and arc-resistant. Not recommended for parts requiring high electric strength or thin sections.
See advertisement, Page 98

1 - - - - - 6 - - - 10
THERMOLUX—Libbey-Owens-Ford Glass Co., Toledo, O. Glass furnished in sheet and laminated form; for casting and spinning into parts; abrasion resistance, high; resists corrosion caused by moisture and acids, except hydrofloric; heat resistant to 160 degrees Fahr.; flexibility, low; dielectric strength, .204 kilovolts per mil; tensile strength, 6000-36,000 lb. per sq. in.; compressive 3000-100,000 lb. per sq. in.; moisture absorption, low; nonflammable; available in color; specific gravity, 2.52; used where light transmission is desired with sound insulation.
See advertisement, Page 168

1 - - - - - - - 8 - 10
THERMOPANE—Libbey-Owens-Ford Glass Co., Toledo, O. Glass with a metal edge furnished in sheet and laminated form for casting and machining into parts; abrasion resistance, high; resists corrosion; heat resistant to 200 degrees Fahr.; flexibility, low; dielectric strength, .204 kilovolts per mil; tensile strength, 6000-36 000 lb. per sq. in.; compressive, 3000-100,000 lb. per sq. in.; nonflammable; moisture absorption low; specific gravity, 2.52; transparent and translucent types; for insulated observation windows.
See advertisement, Page 168

\- 2 - - 5 6 - - - - -
THERMOPLAX—Cutler-Hammer, Inc., Milwaukee. Bituminous base compounded with filler such as asbestos; cold-molded into parts; heat resistance 400-600 degrees Fahr.; nonflammable; dielectric strength 80-100 volts per mil; resistant to corrosion; high polish; tensile strength 2000-4000 lb. per sq. in.; moisture absorption 2 per cent. Used for electrical and heat insulation.

1 - 3 - - - - - - 9 -
THIOKOL—Thiokol Corp., Trenton, N. J. Synthetic rubber, available in two types; furnished in powder or raw sheet form, corresponding to crude rubber; processed in manner similar to rubber; oil corrosion and shock-resistant. Used for hoses carrying oil or gasoline, gaskets, packing, pipeline rings, diaphragms, newspaper printing blankets, etc.

1 - - - - - - - - - -
TRANSFLEX—Irvington Varnish & Insulator Co., Irvington, N. J. A transparent, extruded plastic tubing for electrical insulation. Resists brittleness at temperatures down to —50 degrees Cent., making it especially effective for use on aircraft. Its transparency permits quick location of wire breaks, and colored and marked wires may be easily identified through it. Tensile strength, 3000 lb. per sq. in.; dielectric strength, dry—850 volts per mil; wet—815 volts per mil.
See advertisement, Page 181

1 2 3 - - - - - - - -
TUFFLEX—Libbey-Owens-Ford Glass Co., Toledo, O. Polished plate glass, heat tempered, furnished in sheet and laminated form, for machining into parts; resists corrosion caused by all acids except hydrocloric acid and moisture; heat resistant to 550 degrees Fahr.; flexibility, medium; dielectric strength, .204 kilovolts per mil; tensile strength, 36,000 lb. per sq. in.; compressive, 50-100,000 lb. per sq. in.; produced in clear and colors; specific gravity, 2.5; for machine guards, observation and inspection windows, sight glasses, gage glasses, etc.
See advertisement, Page 168

1 - - - - 5 - - - 9 10
TYGON—The United States Stoneware Co., Akron, O. Synthetic resin, thermoplastic; furnished in flexible or rigid sheets, tubing, rods, or in liquid form; may be molded cast or extruded. Abrasion, impact and corrosion resistant; unaffected by oil, gasoline, water; nonaging; high dielectric and tensile strength. May be transparent, translucent or opaque; available in colors. Nontoxic.
See advertisement, Page 113

3 MILLION TONS OF IRON AND STEEL SCRAP WANTED THIS MONTH!

1—Corrosion resistant
2—High heat resistant
3—Impact resistant
4—High tensile strength
5—High dielectric strength
6—Nonflammable
7—Takes high polish
8—Translucent
9—Available in colors
10—Low moisture absorption

1 2 - - 5 - - - - -
"U. S." STANDARD—The United States Stoneware Co., Akron, O. Acid-proof chemical stoneware available in a wide range of shapes and sizes; resists all corrosives except hydrofluoric acid and hot caustics; for fabrication into tanks; etc., and for lining exhausters and acid-pumps. Hard, durable. available in heat-shock resistant bodies.
See advertisement, Page 113

1 - - - - - - - - 10
UFORMITE—Resinous Products & Chemical Co., Philadelphia. A synthetic resin (adhesive) urea-formaldehyde; furnished in powder form; has low moisture absorption, high density; used in manufacture of waterproof plywood for aircraft and marine use.

1 - 3 - 5 - - - - -
UNISORB—Felters Co. Inc., Boston. Specially controlled felt for vibration absorption. Types and thicknesses available for most frequencies and loadings encountered in industrial field. Also types available for sound absorption. Petroleum-resistant. A special brand cement is also available for use with this material in order to eliminate the need of any other form of hold down such as expansion bolts or lag screws. Holding strength in excess of 40 lbs. per sq. in. when used between the felt and steel, concrete or wood.
See advertisement, Page 116

V

VIBRACORK—Armstrong Cork Co., Lancaster, Pa. Resilient board of cork granules; compressed and baked under pressure; long life and high resistance to deterioration. Material is made in three densities for vibration damping applications.
See advertisement, Page 173

1 - - - - - - - - -
VICTOLENE—Victor Mfg. & Gasket Co., Chicago. Synthetic rubber compound, thermosetting material furnished in sheets and stampings, for molding into parts; resists corrosion caused by oil, gasoline, kerosene, salt water and antifreezes; heat resistant to 250 degrees Fahr.; flexibility, high; tensile strength, 350 lb. per sq. in.; compressive, .038-inch for stock—.190-inch under 2960 lb. per sq. in.; moisture absorption, medium; inflammable; available in brown; shatterproof; specific gravity, 1.12; opaque; for gasketing material, when compressed in position by light metal or plastic stampings, used for sealing fluids.

- 2 - 4 - 6 - - - -
VICTOPAC—Victor Mfg. & Gasket Co., Chicago. Compressed sheet packing with asbestos base for stamping or cutting by hand into parts; high corrosion resistance; flexibility; tensile strength 2500 lb. per sq. in.; heat-resistant; low moisture absorption; nonflammable; impact-resistant; high compressive strength. Used for gasketing and packing.

1 2 - - - - - - - 10
VICTOPRENE—Victor Mfg. & Gasket Co., Chicago. Synthetic elastic, thermosetting; furnished in sheet or molded form. Sheets may be stamped and blanked into parts; corrosion and heat-resistant; tensile strength 1500 lb. per sq. in.; low moisture absorption; shatterproof. Used as a gasketing material.

1 2 - - - 6 - - - 10
VICTOR—Victor Mfg. & Gasket Co., Chicago.

1 2 - - - 6 - - - -
Asbestos sheet, asbestos fiber base; furnished in sheets for stamping or cutting into parts; corrosion resistant; flexible; tensile strength 300 lb. per sq. in.; heat resistance 700 degrees Fahr.; nonflammable; specific gravity .9; high compressive strength; insoluble; some resilience. Used for packing, thermal insulation, and vibration absorption.

1 2 - - - - - - - 10
Cork sheet; vegetable bark in sheet form for stamping and cutting into parts; corrosion resistant; flexible; heat resistance 180 degrees Fahr.; low moisture absorption; specific gravity .27; fair compressive strength; resilient. Used for seals, vibration absorption.

- 2 - 4 - - - - - -
VICTORITE—Victor Mfg. & Gasket Co., Chicago. Vegetable fiber base, sheet packing; furnished for stamping or cutting by hand into machine parts; flexible; tensile strength 3000 lb. per sq. in.; heat resistance 200 degrees Fahr.; nonflammable; impact resistant; specific gravity .675; compressive strength 2000 lb. per sq. in.; resilient. Used for gasketing and packing.

1 - - - - 6 - - - -
VINYLITE—Carbide & Carbon Chemicals Corp., New York.

Unfilled V Series: conjoint polymer of vinyl chloride and vinyl acetate; thermoplastic; furnished in sheets, rods or tubes, elastic sheeting, powder for molding, machining, heat forming, stamping or extruding into parts; corrosion-resistant; takes high polish; flexible; available in colors; nonflammable; moderate tensile strength; dielectric strength 650 volts per mil. Used for machine cabinets, electrical fixtures, transparent windows, dials, drawing and calculating instruments.

Resins: Series "A" (polyvinyl acetates) granular form, and in solution, thermoplastic. Adhesives applied as hotmelt or from solution for metal to metal, metal to glass, etc. Series "X" (polyvinyl acetal) in powder and sheet form, thermoplastic.
Laminated film for safety glass.

Series "Q" (polyvinyl chloride) in powder form.

1 2 - - 5 - - - - -
VITREOSIL—The Thermal Syndicate Ltd., New York. Vitreous silica, ceramic base, furnished in sheet and rods or tubes for molding and drawing into parts; abrasion resistance, high; resists corrosion caused by acid; heat resistant to 2000 degrees Fahr.; nonflexible; very high dielectric strength, even at elevated temperatures; nonabsorbent; compressive strength, high; tensile strength, low; nonflammable; specific gravity, 2.07-2.2; in transparent, translucent and opaque types; can be highly polished; used where high resistance to electrical, thermal and corrosion extremes is required.

1 2 - - - 6 - - - -
VITRIC-10—The United States Stoneware Co., Akron, O. Ceramic-base, nonplastic; furnished in powder form for casting into parts, or as complete parts; corrosion and heat resistant (1000 degrees Fahr.); nonflammable. Available in colors; used for cementing and sealing.
See advertisement, Page 113

- 2 3 - - - - 8 - -
VITROLUX—Libbey-Owens-Ford Glass Co., Toledo, O. Polished plate glass, heat-tempered, ceramic color-fused; furnished in sheet or laminated form for machining into parts; abrasion resistance, medium; resists corrosion caused by all common acids; heat resistant to 550 degrees Fahr.; flexibility, medium; dielectric strength .204 kilo volts per mil; tensile strength, 36.000 lb. per sq. in.; compressive, 50-100,000 lb. per sq. in.; nonflammable; available in colors; not shatterproof but 5-7 times stronger than plate glass; specific gravity, 2.5; translucent and opaque types; soluble in hydrofloric acid; bility etc.
See advertisement, Page 168

- 2 - 4 5 - - - - -
VULCABESTON—Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. Hard rubber, or Neoprene and asbestos base, thermosetting; furnished in sheet and laminated forms or rods and tubes for machining into parts or supplied as complete parts; heat resistance 750 degrees Fahr.; tensile strength 7000 lb. per sq. in.; dielectric strength 40 volts per mil; corrosion resistant; low moisture absorption. Uses include insulation, brake linings, etc.

- - - 4 5 - - - - 10
VULCOID — Continental-Diamond Fibre Co., Newark, Del. Resinous base, thermoplastic; furnished in sheets and laminated forms, or rods and tubes for machining, stamping or forming into parts; low moisture absorption; dielectric strength 400 volts per mil; tensile strength 11,000 lb. per sq. in.; resistant to abrasion; flexible in some forms; heat resistant 275 degrees Fahr.; available in red, gray, black; nonflammable; shatterproof. Used for insulation where arc resistance and moderate moisture resistance are important.

1 - - - 5 - - - - -
VYCOR—Corning Glass Works. Corning, N. Y. Glass is approximately 96 per cent pure silica; in sheets, rods or tubes, cast, molded or machined. Has high heat resistance, very low coefficient of thermal expansion, excellent corrosion resistance (except HF) and dielectric properties. Can be used at much higher temperatures than other glasses; also adaptable to high-frequency insulation. Linear coefficient of expansion .0000005 per degree Fahr.; softening point 2730 degrees Fahr.; maximum operating temperature 1450-1750 degrees Fahr.; tensile strength, 4000-10,000 lb. per sq. in.; compressive strength 50-200,000 lb. per sq. in.; specific gravity 2.2; hardness 5.5-6.5 (Moh's). Available in opaque, transparent and ultraviolet transmitting types; for rotating seal rings, thermocouple sleeves and coil forms.

W

- - 3 4 5 - - - - -
WELDWOOD—United States Plywood Corp., New York. Phenol-formaldehyde and urea-formaldehyde resin-bonded plywood; thermosetting; flexibility varies with thickness; splitproof, shatterproof; high tensile and dielectric strength. Obtainable in waterproof and water-resistant grades in all woods.

- 2 - - - 6 - - - -
WESTFELT—Western Felt Works, Chicago. Felt material; furnished in cut shapes according to user's specifications for vibration dampening, deadening sound, insulating against heat and cold and filtering liquids, air and gases; also furnished as oil or dust seals for bearings.
See advertisements, Pages 183, 189

1 - - - - - - - - -
WESTFELTOPAK—Western Felt Works, Chicago. Gasketing material made of high grade resilient felt, coated all sides with synthetic rubber, resistant to many mineral oils, gasoline, petroleum hydrocarbons, chlorinated solvents, alcohols and dilute acids and alkalis. Recommended maximum temperature 175 degrees Fahr.
See advertisements, Pages 183, 189

- - 3 4 5 - - - - -
WILMINGTON FIBRE—Wilmington Fibre Specialty Co., Wilmington, Del. Cotton rag and paper, chemically treated, nonplastic material; furnished in sheet form or rods and tubes for machining or stamping into parts; dielectric strength 200-400 volts per mil; tensile strength 12-15,000 lb. per sq. in.; resistant to shock and corrosion; high polish; available in colors. Used for electrical and mechanical insulation.

- - - - - - 7 - - 10
WOODEX—Neveroil Bearing Co., Wakefield, Mass. Impregnated rock maple furnished in parts which can be machined; heat resistant to 100 degrees Fahr.; inflammable; can be highly polished; for bearing surfaces in textile, road building, agricultural, tobacco and many other types machinery.

Producers of Plastics and Other Nonmetallics

A

American Cyanamid Co., Beetleware Div., 30 Rockefeller Plaza, New York.
Urea-formaldehyde plastic—BEETLE
Melamine formaldehyde plastic—MELMAC

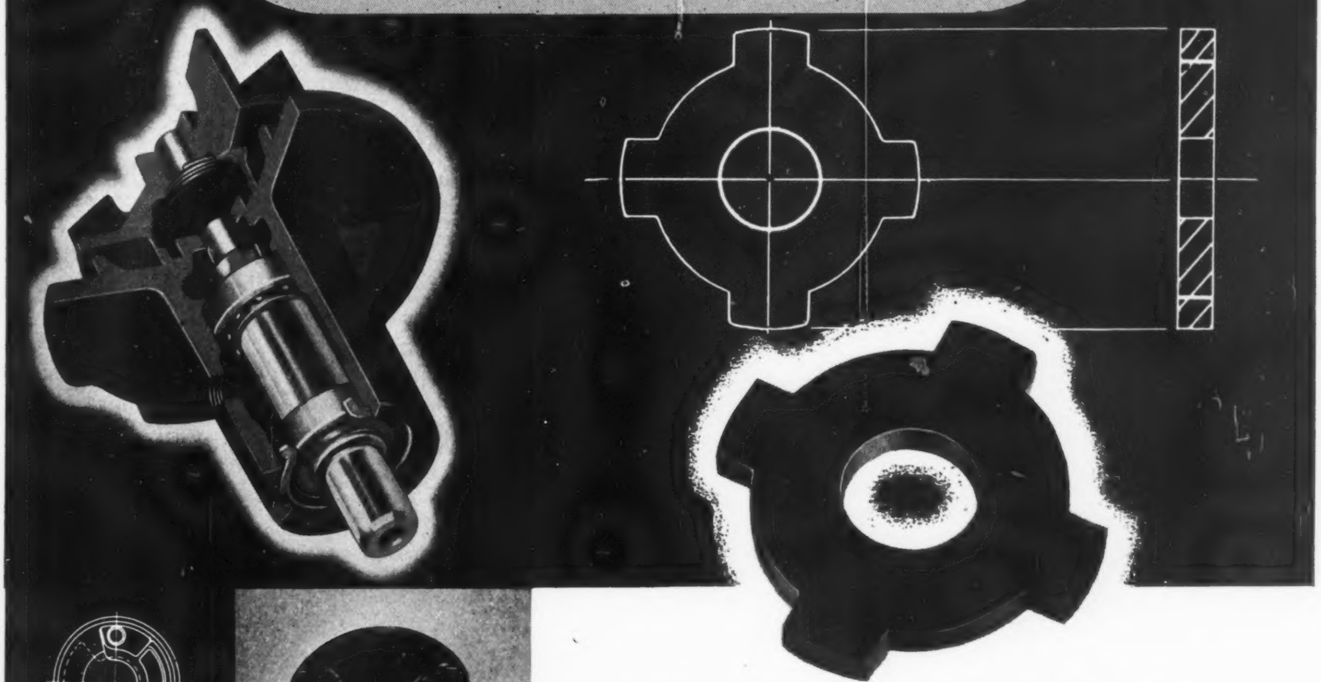
American Felt Co., Glenville, Conn.
Felt material—"K" FELT and AMERICAN FELT
See advertisement, Page 181

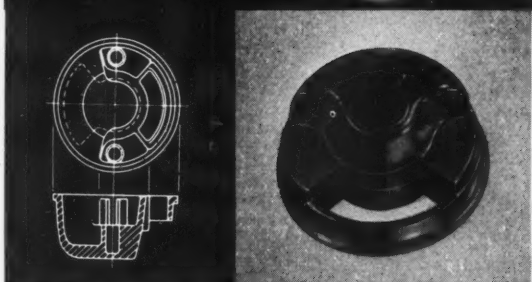
American Hard Rubber Co., 11 Mercer St., New York.
Hard rubber—ACE

American Plywood Corp., New London, Wis.
Phenolic, urea plywood—AMERICAN PLYWOOD

American Products Mfg. Co., Oleander and Dublin Sts., New Orleans.
Cellulose derivative—INCELOID

MORGANITE
SELF-LUBRICATING SPECIALTIES
have the advantages that win battles on the home front, too!





Sticky, gummy deposits—usually found in gasoline meters—will not affect the smooth, even operation of this MORGANITE valve.

Bearing seals for high test gasoline manufacture require high resistance to corrosive acids. MORGANITE seals are particularly applicable here.

MORGANITE water meter discs are self-lubricating, non-contaminating and require only a minimum of effort for efficient operation.

- Compressive Strength - up to 52,000 lbs. per sq. in.
- Tensile Strength - 3,500 lbs. per sq. in.
- Coef of Expansion - .000001 to .000008 per deg. F.
- Hardness - 40 to 50 sclerescope
- Chemical Resistance - not affected
- Temperature Limits - 850 deg. F. in oxidizing atmosphere
- Impact Strength - .10 to 1.5 ft. lb. Izod

The MORGANITE seal for ordnance, chemical process and industrial pump applications, shown above, is but one of the direct results of resourceful engineering and research. Its widespread acceptance is accounted for because friction is at a minimum, making shaft wear negligible, and requiring only slight power to drive it.

MORGANITE self-lubricating components have greater load and speed capacity than metal-to-metal contacting surfaces. Lubrication is eliminated under ordinary conditions, and frictional losses are low.

Available in a wide range of compositions and grades, MORGANITE can be machined to very close tolerances. In fact, accuracy is possible comparable to die-casting and plastic molding. Write today for illustrated literature. MORGANITE engineers will gladly collaborate in working out your problems; there is no obligation of course.

TRADE MARK

MORGANITE BRUSH CO., INC.

LONG ISLAND CITY, NEW YORK

American Wringer Co., Woonsocket, R. I.
Rubber rolls—TENSILASTIC

Am-mex Sales Co. Inc., 28 Church St., Buffalo.
Plastic-bonded plywood — SWEET HOME BRAND

Armstrong Cork Co., Lancaster, Pa.
Cork-and-synthetic-rubber—ARMSTRONG
Resilient board of cork granules—VIBRACORK

See advertisement, Page 173

B, C

Bakelite Corp., 30 E. 42nd St., New York.
Phenolic plastics—BAKELITE

See advertisements, Pages 104-105

Booth Felt Co., 444—19th St., Brooklyn, N. Y.
Wool base felt—BOOTH FELT

Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.
Material for impregnated wood bushings, etc. —NIGRUM

See advertisement, Page 183

Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York.
Resinous plastic—VINYLITE

Catalin Corp., 1 Park Ave., New York.
Phenolic plastics—CATALIN, PRYSTAL and CATABOND

Celanese Celluloid Corp., 180 Madison Ave., New York.
Cellulose acetate plastic—LUMARITH
Cellulose nitrate plastic—CELLULOID
Cellulose acetate (transparent) sheet—LUMARITH

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago.
Synthetic rubber compounds—SIRVENE
Heat-resisting leather—SIRVIS

Colt's Patent Fire Arms Mfg. Co., 17 Van Dyke Ave., Hartford, Conn.
Hard rubber and asbestos base material—VULCABESTON

Columbian Rope Co., Auburn, N. Y.
Phenolic resin base—CO-RO-LITE

Continental-Diamond Fibre Co., Newark, Del.
Phenolic plastic—DILECTO, CELORON
Resinous plastic—VULCOID
Vulcanized fibre—DIAMOND
Flexible material—MICABOND
Resinous plastic—DILECTENE
Insulating material—DILECTENE

Corning Glass Works, Corning, N. Y.
Ceramic base glass—PYREX and VYCOR

Cutler-Hammer Inc., 12th and St. Paul, Milwaukee.
Bituminous plastic—THERMOPLAX
Asbestos base material—PYROPLAX

D

Densewood Corp., The, Elkhorn, Wis.
Impregnated wood—DENSEWOOD

Dow Chemical Co., Midland, Mich.
Plastic granules—ETHOCEL
Thermoplastic—STYRON
Fibrous thermoplastic—SARAN

Du Pont de Nemours, E. I., & Co. Inc., Wilmington, Del.
Chloroprene rubber—NEOPRENE
Plastic coated wire mesh—CEL-O-GLASS
Nitrocellulose base—PYRALIN
Polymethyl-methacrylate base—LUCITE
Cellulose acetate base—PLASTACELE
Polyvinyl alcohol—PVA
Thermoplastic—NYLON

Durez Plastics & Chemicals Inc., North Tonawanda, N. Y.
Phenolic plastic—DUREZ

Durite Plastics Inc., 5000 Summerdale Ave., Philadelphia.
Phenol-furfural plastic—DURITE

F, G

Farley & Loetscher Mfg. Co., Dubuque, Iowa.
Phenolic and urea plastic—FARLITE
Fibrous core with laminated Bakelite surface —FARLOEX

Felters Co. Inc., 210 South St., Boston.
Laminated felt—DUFELT
Felt for vibration, isolation, etc.—UNISORB
Felt for grease and oil retention—FELTERS CERTIFIED FELT

See advertisement, Page 116

Formica Insulation Co., 4613 Spring Grove Ave., Cincinnati, O.
Laminated resinous plastic—FORMICA
Phenolic impregnated wood—PREGWOOD

See advertisement, Page 95

Franklin Fibre-Lamitex Corp., 190 E. Twelfth St., Wilmington, Del.
Phenolic base, thermosetting material—LAMITEX
Hard vulcanized fiber—FRANKLIN

Garfield Mfg. Co., Garfield, N. J.
Thermosetting materials—GUMMON (black); HERMIT (gray-white); TEGIT and GARIT

Gemloid Corp., 79-10 Albion Ave., Elmhurst, L. I., N. Y.
Tubing and gasketing material—GEMFLEX
Thermoplastic and thermosetting materials—GEMLOID

General Electric Co., 1 Plastic Ave., Pittsfield, Mass.
Nonrefractory and refractory materials—TEXTOLITE; Two types
Ceramic base—MYCALEX

See advertisement, Page 98

Thermoplastic—KOROSEAL

Goodrich, B. F., Co., Akron, O.
Thermoplastic—KOROSEAL

H, I, J

Haskelite Mfg. Corp., 208 Washington St., Chicago.
Plastic-bonded plywood—HASKELITE and PLYMETL

Hycar Chemical Co., Akron, O.
Synthetic rubbers—HYCAR

Irvington Varnish & Insulator Co., Irvington, N. J.
Thermoplastic—IRV-O-LITE
Varnished tubing—TRANSFLEX and HYFLEX
Insulating varnishes—IRVINGTON
Synthetic resin varnish—HARVEL
Varnished slot insulations—IRV-O-SLOT

Johns-Manville, 22 E. 40th St., New York.
Diatomaceous silica material—CELITE
Rubbery, asphaltic-asbestos material — AERTITE
Asbestos, fiber, graphite and rubber compound—EEL-SLIP
Weatherproof coating—INSULKOTE
Fireproof material—TRANSITE
Refractory material—FIRECRETE

K, L

Keasbey & Mattison Co., Ambler, Pa.
Asbestos materials—HY-TEMP, FEATHERWEIGHT

Knight, Maurice A., Kelly Ave., Akron, O.
Depolymerized colloidal resin plastic—PYROFLEX

Libbey-Owens Ford Glass Co., Nicholas Bldg., Toledo, O.
Figured and wire glass—LIBBEY
Polished plate glass—VITROLUX, TUFFLEX and LOF
Glass with metal edge—THERMOPANE
Heat-absorbing plate glass—LIBBEY
Glass sheet—THERMOLUX

See advertisement, Page 168

Linsky Co., M. A., 2138 W. Washington, Los Angeles.
Cellulose plastic—PLATILIN

Lord Mfg. Co., Erie, Pa.
Rubber bonding—LORD

See advertisement, Page 109

Luzerne Rubber Co., Dewey St., Trenton, N. J.
Hard rubber, thermoplastic—LUZERNE HARD RUBBER

M, N

Makalot Corp., 262 Washington St., Boston.
Synthetic resin plastic—MAKALOT

Masonite Corp., 111 W. Washington St., Chicago.
(a) Exploded wood fiber—MASONITE

Mica Insulator Co., 200 Varick St., New York.
Phenolic and urea-base plastic—LAMICOID

Miller Rubber Industrial Products Div., Akron, O.
Synthetic rubber—AMERIPOL

See advertisement, Page 185

Monsanto Chemical Co., Plastics Div., Springfield, Mass.
Cellulose nitrate plastic—NITRON
Cellulose acetate—FIBESTOS
Phenolic plastic—OPALON and RESINOX
Polyvinyl acetal plastic—SAFLEX

National Carbon Co. Inc., Madison Ave. & W. 117th St., Cleveland.
Carbon or graphite in amorphous or graphitic form—NATIONAL CARBON

National Vulcanized Fibre Co. Wilmington, Del.
Laminated Bakelite—PHENOLITE
Cotton cellulose base, vulcanized fiber—NATIONAL FIBRE, NATIONAL SWITCH INSULATION
Cotton-rag base, fish-paper insulation—PEERLESS

See advertisement, Page 189

Neveroil Bearing Co., Wakefield, Mass.
Impregnated maple bearings—WOODEX

O, P, R

Owens-Corning Fiberglass Corp., Toledo, O.
Glass, in fibrous form—FIBERGLAS

Panelyte Div., St. Regis Paper Co., 230 Park Ave., New York.
Synthetic laminated resinous material — PANELYTE

Parkwood Corp., 24 Water St., Wakefield, Mass.
Phenolic base—HYDEN

Penn Fibre & Specialty Co., 2030 E. Westmoreland St., Philadelphia.
Phenolic base-material—PHENOL FIBRE
Paper base material—PENN Vulcanized Fibre

Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh.
Laminated plate glass—DUPLATE, DUOLITE, AEROLITE, MULTIPLATE, FLEXSEAL
Heat-treated plate glass — HERCULITE

See advertisement, Page 91

Plaskon Co. Inc., 2112 Sylvan Ave., Toledo, O.
Urea formaldehyde plastic—PLASKON

Pylock Corp., subsidiary of M & M Wood Working Co., Portland, Ore.
Phenol-formaldehyde bonded plywood—RESNPREST

Polaroid Corp., Cambridge, Mass.
Light-polarizing glass—POLAROID

Reilly Tar & Chemical Corp., Merchants Bank Bldg., Indianapolis.
Phenolic plastic—INDUR, INDUR VARNISH

Resinous Products & Chemical Co., 222 West Washington Sq., Philadelphia.
Plastic bonded plywoods—AMBERLITE, TEGO and UFORMITE

Resistoflex Corp., Belleville, N. J.
Synthetic resin base—RESISTOFLEX

Richardson Co., The, Melrose Park, Ill.
Thermosetting, thermoplastic and translucent plastics—INSUROK
Hard rubber—RUB-TEX and RUB-EROK
Acid-resisting bituminous plastic—EBROK
Sheet (plate) mica—MICAROK

See advertisement, Page 91

Rohm & Haas Co. Inc., 222 W. Washington Sq., Philadelphia.
Acrylic base plastic — PLEXIGLAS and CRYSTALLITE

See advertisement, Page 87

Ryerson & Son Inc., Jos. T., 16th and Rockwell Sts., Chicago.
Bearing material—RYERTEX

S, T, U

Safetee Glass Co., Philadelphia.
Glass and plastic base—SAFETEE GLASS

Spaulding Fibre Co. Inc., Tonawanda, N. Y.
Fibrous material — SPAULDING FIBRE, SPAULDING ARMITE and SPAULDO
Phenolic plastic—SPAULDITE

Synthane Corp., Oaks, Pa.
Laminated Bakelite—SYNTHANE

Taylor Fibre Co., Norristown, Pa.
Phenolic base thermosetting material—TAYLOR FIBRE

Tennessee Eastman Corp., Kingsport, Tenn.
Cellulose ester plastics—TENITE

Thiokol Corp., Trenton, N. J.
Synthetic rubber—THIOKOL

United States Plywood Corp., 46th St. and 12th Ave., New York.
Resin-bonded plywood—WELDWOOD

United States Stoneware Co., Akron, O.
Chemical Stoneware—"U.S." STANDARD
Ceramic, nonplastic—VITRIC-10
Resinous thermoplastic—RESILON
Synthetic resins—TYGON

See advertisement, Page 113

V, W

Victor Mfg. & Gasket Co., 5750 Roosevelt Rd., Chicago.
Compressed sheet packing—VICTOPAC
Vegetable fiber base sheet packing—VICTORITE
Asbestos sheet—VICTOR
Cork sheet—VICTOR
Compounded synthetic rubber — VICTROPRENE
Synthetic rubber—VICTOLENE

Watertown Mfg. Co., The, Watertown, Conn.
Phenolic base plastic—NEILLITE

Western Felt Works, 4117 Ogden St., Chicago.
Felt material—WESTFELT, GASKOFELT WESTFELTOPAK and RESISTOFELT
Synthetic rubber—ACADIA

See advertisements, Pages 183, 189

Westinghouse Electric & Mfg. Co., Trafford, Pa.
Phenolic plastic—MICARTA

Westinghouse Electric & Mfg. Co., Derry, Pa.
Ceramic base—PRESTITE

Westport Products Co. Inc., Westport, Conn.
Fibrous material—SEYBOLITE

Wilmington Fibre Specialty Co., Wilmington, Del.
Paper base material—FYBROID
Cotton rag and paper, nonplastic—WILMINGTON FIBRE
Phenolic plastic—OHMOID

Hard-Working Mazlo Magnesium Equipment appreciates a little attention

Manufacturing operations move faster, more smoothly, because of the many lightweight Magnesium Alloy machine parts and equipment employed. You can't get replacements—fighting men are taking all of these lightweight products we can produce—so ways and means of making present equipment last longer become tremendously important.

Protect the surface of Magnesium Alloy parts and they're certain to have longer life. This subject and other information on Mazlo Magnesium Alloys is included in the publications listed below. Use the coupon to request copies.

ALUMINUM COMPANY OF AMERICA
(Sales Agent for Mazlo Magnesium Products)
1703 Gulf Building, Pittsburgh, Pa.
Send me—

- ☐ Magnesium Surface Protection
- ☐ Properties of Mazlo Magnesium Products
- ☐ Machining of Mazlo Magnesium Alloys
- ☐ Data Book: "Mazlo Magnesium Alloys"

Signed__________________ Title__________

Company____________________________

Address____________________________

MAZLO
REG. U.S. PAT. OFF.

AMERICAN MAGNESIUM CORPORATION
SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

Stampings Producers

Reference letters beneath addresses of companies refer to: (a) Types, materials and sizes of stampings; (b) Names of stamped machine parts customarily produced; and (c) Machining, heat-treating or assembling facilities.

A

Accurate Spring Mfg. Co., 3811 W. Lake St., Chicago.
(a) Blanking, forming and perforating all metals, small and medium sizes, specializing in spring materials.
(b) To customers' specifications.
(c) Complete facilities.

Ace Mfg. Corp., 1201 E. Erie Ave., Philadelphia.
(a) Flat, drawn and formed stampings of all materials, 5-75 tons pressure capacity. Sizes 20 in. square light and heavy gages.
(b) To customers' specifications.
(c) Complete facilities.

Acklin Stamping Co., 1925 Nebraska Ave., Toledo, O.
(a) Pressed metal parts of steel, brass and aluminum to 40 in. dia., .010 to ⅝ in. metal thickness.
(b) To customers' specifications.
(c) Complete facilities.

Adell Corp., 61 E. River St., Orange, Mass.
(a) Flat, drawn and formed hot and cold-rolled stainless steel stampings, to 100-ton press capacity.
(b) Universal joints, textile parts, gun parts, etc.
(c) Machining and heat treating.

Advance Stamping Co., 7075 Lyndon Ave., Detroit.
(a) Terminals, small drawn shells in steel, carbon and stainless steel, brass, copper, aluminum and monel metals; shells $\frac{1}{16}$-1½ dia. Largest blank 16 gage, 2½ dia.
(b) Small parts for electrical equipment, etc.
(c) None.

Alto Mfg. Co., 1647 Wolfram St., Chicago.
(a) Stamped, drawn and formed steel, copper, brass, aluminum and gilding metal stampings from ⅛ x ⅛ to 10 x 40; from .001 to .375; tolerances as low as .002.
(b) Rotating bands, and other machine parts.
(c) Complete facilities.

Aluminum Goods Mfg. Co., Washington St., Manitowoc, Wis.
(a) Stampings, spinnings and deep drawings in aluminum, stainless steel and other metals.
(b) Refrigerator, radio, textile, electrical, airplane and automotive parts.
(c) Complete facilities.

American Emblem Co. Inc., Box D 116, Utica, N. Y.
(a) Art metal and intricate stampings up to 16 in. square; .003 to .25-in. metal thickness.
(b) Embossed nameplates, radio escutcheons and dials and ornamental trim and stampings.
(c) Complete facilities.

American Pulley Co., 4200 Wissahickon Ave., Philadelphia.
(a) Pressed steel stampings in light to heavy steel gages; also deep drawn stampings.
(b) To customers' specifications.
(c) Complete facilities.

American Stamping Co., Battle Creek, Mich.
(a) Flat, drawn and formed stampings in all metals, small and medium.
(b) Grease cups, oil cups, and automotive, radio and aircraft parts.
(c) Complete facilities.

Amesbury Metal Products Co., Inc., 39 Oakland St., Amesbury, Mass.
(a) Stampings from deep drawn and cold rolled steel, brass, aluminum, nicral and copper.
(b) Marine lamp equipment, clock cases, mechanisms, and fluorescent lighting equipment.
(c) Complete facilities.

B

Barnes-Gibson-Raymond Div., Associated Spring Corp., 6391 Miller Ave., Detroit. (The Cook Plant—Ferry Field and Boulevard drive, Ann Arbor, Mich.)
(a) Small flat springs and stampings from carbon and alloy steels and nonferrous metals.
(b) Special small stampings, formed flat wire parts, catches, clips, contacts, snap rings, retainers and washers.
(c) Complete facilities.

Barth Stamping & Machine Works, 3815 W. 34th St., Cleveland.
(a) Flat, drawn and formed stampings of any material in small, medium-large sizes, also high production stamping.
(b) To customers' specifications.
(c) Information not available.

Basca Mfg. Co. Inc., 3019 Roosevelt Ave., Indianapolis.
(a) Tube forming and small flat, drawn, formed stampings of cold-rolled and hot-rolled pickled steel up to No. 12 U.S.S. Ga. steel; small and medium sized.
(b) Automotive muffler parts.
(c) None.

Bossert Co. Inc., The, 1002 Oswego St., Utica, N. Y.
(a) Stampings from .005 to 1 in. in thickness, any metal.
(b) Automotive, refrigeration, washing machine, radio, etc.
(c) Assembling and welding facilities.

Brewer-Titchener Corp., The, 111 Port Watson St., Cortland, N. Y.
(a) Flat, formed, and drawn stampings of ferrous and nonferrous, stainless, etc., up to 30 x 60 in. in size and 4 in. max. draw.
(b) To customers' specifications.
(c) Complete facilities.

Bridgeport Chain & Mfg. Co., The, Bridgeport, Conn.
(a) Small, flat stampings of steel, brass and bronze, to .065 in. gage, 4 in. length or dia.
(b) To customers' specifications.
(c) Complete facilities.

Briggs Mfg. Co., 11631 Mack Ave., Detroit.
(a) All types of steel and aluminum stampings in sizes to about 12 ft. x 7 ft.
(b) Aluminum parts assembled into airplane wings, control surfaces, etc.
(c) Machining and finishing.

Budd, Edward G., Mfg. Co., Philadelphia, (Detroit branch located at 13141 Charlevoix Ave.)
(a) Automobile body and large and small special stampings of mild and stainless steels.
(b) Automotive, chemical and rayon, railway passenger car, commercial truck trailer, marine and aircraft parts.
(c) Complete facilities.

Buffalo Brake Beam Co., 140 Cedar St., New York.
(a) Small stampings from light bars and strip stock.
(b) To customers' specifications.
(c) Information not available.

By-Products Steel Corp., Coatesville, Pa.
(a) Flat plates pressed, bent, sheared or blanked, and flame-cut steel shapes, in gages from No. 10 to 25 in. thick.
(b) To customers' specifications.
(c) Information not available.

C

Chapin, The R. E., Mfg. Works Inc., 29 Liberty St., Batavia, N. Y.
(a) Blanks to 26-in. dia. light gage.
(b) Sprayers, atomizers, pumps, steel barrels.
(c) Machining.

Chase Brass & Copper Co. Incorporated, 236 Grand St., Waterbury, Conn.
(a) All types sheet metal stampings, drawn shells of brass, copper and copper alloys.
(b) All types of parts.
(c) Machining, polishing, plating and assembling facilities.

City Auto Stamping Co., Lint and Dura Ave., Toledo, O.
(a) Large light-gage stampings.
(b) Automotive.
(c) Assembling facilities.

Cleveland Steel Products Corp., Plant No. 2, Wellington, O.
(a) All types to 12 in. draw, 12 in. dia. ¼ in. thick.
(b) Automotive, industrial and electrical.
(c) Complete secondary operation, cyanide hardening, plating and assembling.

Columbia Metal Stamping Co., The, 11900 Harvard Ave., Cleveland.
(a) Light and medium stampings in all metals to ¼ in. thick, to 24 x 24 in. Deep drawn to 3½ in. deep, ⅛ thick.
(b) Automotive, electrical, industrial and general.
(c) Complete facilities.

Commercial Shearing & Stamping Co., 1775 Logal St., Youngstown, O.
(a) To 60 in., ¾-in. gage, steel and copper alloys, aluminum and stainless steel.

Careful segregation and identification of alloy iron and steel scrap should be standard procedure in every plant collection program.

1. It helps conserve essential, scarce alloying elements.
2. It helps eliminate wasted time, material and effort in the steel mills.

Alloying elements such as cobalt, molybdenum, nickel and tungsten are readily recoverable from scrap. If their presence in a lot is known, the scrap can be used in making up a charge of alloy steel of the same or similar analysis. The amount of alloying elements that must be taken from stock is reduced.

But, if, through lack of segregation, alloy scrap gets into a charge where no alloys are wanted, such as a plain carbon steel, the alloying elements are utterly wasted. It is also possible that the heat itself will be lost because of failure to meet specifications.

The difficulties of scrap segregation increase with every handling. The source is the best point for segregation. Comparatively little time and trouble taken there will save a great deal of trouble and wasted time at the mill.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

MOLY

Climax Mo-lyb-den-um Company
500 Fifth Avenue · New York City

(b) Tank heads and water heater parts.
(c) Machining and assembling facilities.

Croessant Machine Works, 39-41 Moss St., Reading, Pa.
(a) Flat and formed stampings of steel, brass and aluminum in various sizes; 80-ton press capacity.
(b) Screw anchors, etc.
(c) Machining and assembling facilities.

Cuyahoga Spring Co., The, 10301 Berea Rd., Cleveland.
(a) Stampings of cold-rolled steel, up to No. 10 gage; flat springs stamped or formed and tempered for mechanical purposes; also brass, bronze stampings.
(b) Primarily flat springs.
(c) Complete facilities.

D

Dahlstrom Metallic Door Co., Buffalo St., James-Town, N. Y.
(a) Steel, stainless steel, brass, bronze, aluminum stampings and drawn parts. Press equipment Bliss 3-B to 8-E, Toledo press (bed 88 in. x 44 in.), brake presses for sections 10 to 12 ft. long.
(b) Machine guards, cabinets, latches, brackets and special parts.
(c) Assembling facilities.

Dayton Rogers Mfg. Co., 2835-12th Ave., Minneapolis.
(a) Stampings of steel, brass, copper and other sheet alloys, as well as bakelite and similar synthetics.
(b) Metal stampings in small lots for the aircraft industries including all instruments and other stamped products required in limited quantities.
(c) Pneumatic die cushions adaptable to all power presses for the sheet metal working trade.

Diamond Expansion Bolt Co., Inc., Garwood, N. J.
(a) Blanking, piercing and bending, strip steel, brass, copper and aluminum; from small to capacity of 70-ton press.
(b) Cable straps, toggle bolts, hammer drive anchors, etc.
(c) Complete facilities.

Dickey-Grabler Co., 10302 Madison Ave., Cleveland.
(a) Medium and small flat or formed stampings of steel, stainless steel, brass, copper, aluminum, duralumin, zinc, lead, sheet bronze and fibers; $\frac{1}{16}$ in. thick or lighter, up to 15 in. round or square.
(b) Various machine parts.
(c) Light machining and assembling.

Dill Mfg. Co., The, 700 E. 82nd St., Cleveland.
(a) Small brass and steel stampings.
(b) Ferrules, etc.
(c) Machining and assembling.

Duplex Mfg. Corp., Sherman, N. Y.
(a) All type stampings of steel or galvanized sheets, small and large.
(b) Brackets. braces, airplane parts and other small parts.
(c) Complete facilities.

Dunbar Brothers Co., Div. of Associated Spring Corp., Bristol, Conn.
(a) Flat and formed stampings of spring steel, stainless and other alloys in small sizes.
(b) Information not available.
(c) Heat-treating facilities.

E

East Side Metal Spinning & Stamping Corp., 1301 West Elizabeth Ave., Linden, N. J.
(a) Flat, drawn and formed stampings of steel, aluminum, copper and brass; 16 in. dia. to 5 in. depth; 4½ in. dia. to 7 in. depth.
(b) General machine parts.
(c) Heat-treating and assembling facilities.

Erie Art Metal Co., 18th and Schaal Ave., Erie, Pa.
(a) All types of fabricated sheet metal stampings.
(b) Metal cabinets built to order, vault boxes, etc.
(c) Complete facilities.

Eureka Tool & Machine Co., 17 W. 54th St., New York.
(a) Small and medium stampings.
(b) To customers' specifications.
(c) Complete facilities.

F

Falstrom Co., 34 Main Ave., Passaic, N. J.
(a) Fabricated steel parts of all kinds.
(b) Machine bases, frames, guards, instrument panels, etc.
(c) Machining and assembling facilities.

Fox Co., Fox Bldg., Cincinnati.
(a) Metal stampings.
(b) Nameplates, escutcheons, etc.
(c) Assembly facilities.

G

Geometric Stamping Co., The, 1111 E. 200th St., Cleveland.
(a) Any type stampings in steel, stainless steel, brass, etc., ½ in. thick, 48 x 48 in.
(b) Dairy, washing machine, radio, railroad and automobile parts, etc.
(c) Complete facilities.

Geuder, Paeschke & Frey Co., 324 N. 15th St., Milwaukee.
(a) Deep drawn in all metals to 48 in. dia. 18 in. deep, 12-30 gage.
(b) Government sheet metal work.
(c) Complete facilities.

Gibson Co., William D., Div. of Associated Spring Corp., 1800 Clybourn Ave., Chicago.
(a) Miscellaneous stampings of cold-rolled spring steel, stainless and alloys, small and medium.
(b) Springs.
(c) Heat treating facilities.

Globe Machine & Stamping Co., The, 1250 W. 76th St., Cleveland.
(a) Metal stampings of all sizes.
(b) Stamping assemblies, tumbling and burnishing barrels.
(c) Machining and assembling facilities.

Goat Metal Stampings Inc., 314 Dean St., Brooklyn.
(a) Stamped, formed, drawn light sheet metal, steel, stainless steel, nickel, silver, tantalum, Monel, molybdenum, brass, copper, tin plate and zinc; .001 to ⅛ in., 1 to 10,000 per lb.
(b) Special cups, clips, caps, eyelets, etc.
(c) Light manufacturing and assembling.

Grammes, L. F., & Sons Inc., Allentown, Pa.
(a) Stampings of brass, aluminum, steel, etc.
(b) Automotive, radio, clock and electrical.
(c) Complete facilities.

Gray, Peter, Corp., 290 Third St., Cambridge, Mass.
(a) Steel and nonferrous metals, drawn, stamped and formed, up to $\frac{3}{16}$ in. thick; 4 to 400 ton presses with bed areas up to 25 sq. ft. Power hand brakes for 10-gage material by 8 ft. long.
(b) Handles, guards, stop motions, meters, fans, covers, radio, refrigerator casings, propeller heads, and textile machine parts.
(c) Complete assembling and finishing.

Gregory Mfg. Co., 67 Franklin St., New Haven, Conn.
(a) Flat, up to 10 in. x 10 in., formed and drawn stampings of brass, steel, copper and aluminum. Maximum depth of draw 1¼ in.; small to medium sizes—maximum blank 10 in. x 10 in.
(b) Electric knife switches, spring tension washers, etc.
(c) Complete facilities.

Griest Mfg. Co., The, New Haven, Conn.
(a) Small stampings, specializing on forming operations.
(b) Business machine, photographic, electrical, sewing machine parts and assemblies.
(c) Complete facilities.

Griffith-Hope Co., 6607 W. Mitchell St., West Allis, Wis.
(a) Stampings of 30 gage to 10 gage drawn shapes, and shells up to 5 in. in depth.
(b) Automobile stampings, etc.
(c) Assembling facilities.

Guarantee Specialty Mfg. Co., The, E. 96th St., Cleveland.
(a) Flat and drawn stampings, drawing not exceeding 4 in. deep; of sheet steel, band iron, sheet and coil brass, copper, bronze and aluminum in small and medium sizes.
(b) Washers, shims, brackets, cups, levers, etc.
(c) Heat treating and finishing.

H

Hardy Mfg. Corp., Pendleton, Ind.
(a) Flat, drawn, formed and rolled stampings of steel, brass and aluminum up to 24 x 24 in.
(b) Radiator shutters, radio parts, hair dryers, etc.
(c) Assembling and finishing.

Harvey Machine Co., 6200 Avalon Blvd., Los Angeles.
(a) All kinds of blanking, deep drawing, forming in all metals. Sheet metal fabrication.
(b) All types of machine parts.
(c) Complete facilities.

Heyman Mfg. Co., Michigan Ave., Kenilworth, N. J.
(a) Blanked and formed stampings of strip steel, brass, copper and aluminum to $\frac{1}{16}$ in. thick and 6 in. long.
(b) Electrical contacts and aircraft brackets.
(c) None.

Hubbard, M. D., Spring Co., Pontiac, Mich.
(a) Small stampings in spring steels, hot and cold-rolled steel, brass, bronze, aluminum, Monel and stainless steel.
(b) Expansion plugs, washers, flat springs and spring washers.
(c) Drilling, tapping, spot welding, and heat treating.

Hunter Pressed Steel Co., Lansdale, Pa.
(a) All types, small and medium; max. 15 in. blank, ⅛ in. stock.
(b) All types of machine parts.
(c) Complete facilities.

I

Indiana Pressed Steel Co., Muncie, Ind.
(a) Medium and medium-large stampings in all metals.
(b) Refrigerator, automotive, radio, electrical, etc.
(c) Complete facilities.

K

Kiekhaefer Mfg. Co., 901 S. Second St., Milwaukee.
(a) Small and medium stampings of steel, brass, copper and aluminum.
(b) Valve spring washers, special washers, tubing and wire clips, engine front and rear plates, plugs, etc.
(c) None.

Kirk & Blum Mfg. Co., The, 2850 Spring Grove Ave., Cincinnati, O.
(a) All types except heavy or deep-drawn

To conserve nickel and chromium, all industry is cooperating to limit the use of stainless steels to vital applications where only stainless will do the job. For such applications Copperweld Steel Company is furnishing Aristoloy Stainless steel bars and billets. We'll be glad to discuss your stainless steel applications with your engineering staff.

stampings; in steel, copper, brass, aluminum, stainless and monel, to 48 in. wide max., 120 in. long max.
(b) Machine bases, pedestal, guards, lathe pans, truck body and cab parts.
(c) Assembling facilities.
See advertisement, Page 195

Klein Mfg. Co., Burlington, Ia.
(a) Steel and galvanized iron stampings.
(b) To customers' specifications.
(c) Complete facilities.

Knott, A. J., Tool & Mfg. Corp., 6 Front St., Milford, Mass.
(a) Medium and light metal stampings; in all types, of steel, brass, phosphor bronze, aluminum and nickel-silver.
(b) To customers' specifications.
(c) Heat-treating and assembling facilities.

L

LaGanke & Sons Stamping Co., 864 E. 140th St., Cleveland.
(a) Blanked, pierced, formed, drawn, and embossed stampings of stainless steel, steel, brass, copper, aluminum and aluminum alloys, with press capacity to 70 tons.
(b) Internal and external thread protectors, stamped nuts, baffles, ferrules, etc.
(c) Assembling facilities.

Laminated Shim Co. Inc., Glenbrook, Conn.
(a) Small, flat, brass; all types of steel, zinc, copper, etc.
(b) Shims.
(c) None.

Lansing Stamping Co., Lansing, Mich.
(a) Flat, drawn and formed stampings; of steel sheets, strip and plates; small to medium.
(b) To customers' specifications.
(c) Limited facilities.

Larson Tool & Stamping Co., Attleboro, Mass.
(a) All types of stampings in metals from very small to moderately heavy sizes.
(b) All types of machine parts.
(c) Machining and finishing.

Leake Stamping Co., The, 1250 East First St., Monroe, Mich.
(a) Drawn, formed, flat, steel, brass, copper and aluminum stampings in all sizes requiring up to 400-ton pressure with 20-inch stroke.
(b) To customer's specifications.
(c) Welding facilities.

Lee Spring Co. Inc., 30 Main St., Brooklyn.
(a) Flat, punched and formed stampings of spring steel, stainless, brass, copper, bronze, etc., from strip material only, up to 3 in. wide.
(b) Spring washers, spring clips, etc.
(c) Heat-treating and finishing facilities.

Lewyt Metal Products Co., 60 Broadway, Brooklyn.
(c) Sheet metal stamping.
(b) Boxes, housings and cabinets.
(c) Machining and assembling facilities.

Lovejoy-Patent Specialty Co. Inc., 12 River St., Hoosick Falls, N. Y.
(a) Steel, brass or alloy stampings that can be produced on No. 18 and No. 19 Bliss equipment.
(b) Chaplets.
(c) Machining and assembling facilities.

Lukens Steel Co., Coatesville, Pa.
(a) Flat plate stampings and shapes to 195 in. wide or 25 in. thick; spun and pressed heads and other pressed shapes in gages from No. 10 to 6 in.
(b) To customers' specifications.
(c) Information not available.

M

McCauley Metal Products Inc., 660 Grant St., Buffalo.
(a) Wide variety of stampings of steel, bronze, aluminum and brass, to 250-ton pressure; extreme depths from medium size blanks only, shallow depths from blanks up to 48 in.
(b) General machine parts.
(c) Complete facilities.

Metal Auto Parts Co. Inc., 1428 W. Henry St., Indianapolis.
(a) Flat, drawn, deep-drawn and formed stampings of steel and aluminum in medium and large sizes.
(b) Hoods, fenders, running boards, roofs, cowls, etc.
(c) Assembling facilities.

Metal Marker Mfg. Co., The, 1384 E. 40th St., Cleveland.
(a) Flat and formed stampings of steel, brass, zinc and aluminum in small sizes.
(b) Stamped, embossed plates and tags.
(c) None.

Metal Parts & Stamping Co., The, Covington, Ky.
(a) Flat, drawn and formed stampings of brass, aluminum and steel; press range of 15-55 tons.
(b) Various.
(c) Complete facilities.

Midland Steel Products Co., Cleveland (Another plant at Detroit).
(a) Flat, formed and drawn stampings of .05-.3 carbon and high tensile steels in small, medium and heavy sizes to 25 ft. long.
(b) Automotive, lathe pans, etc.
(c) Machining and assembling facilities.

Milcor Steel Co., 4100 W. Burnham St., Milwaukee.
(a) Flat, drawn, formed and intricate stampings of all types, in hot and cold-rolled and galvanized sheets, copper, tin, etc., 16 gage to 30 gage; very small to medium large (6 sq. ft. max.).
(b) To customers' specifications.
(c) Complete machining and assembling.

Morrison Products Inc., 16816 Waterloo Rd., Cleveland.
(a) All gages up to ¼ in., deep drawn stampings up to 6 in. deep, in steel and other metals.
(b) All types of machine parts.
(c) Complete assembling, spotwelding, riveting, machining and japanning facilities.

Mullins Mfg. Corp., Salem, O. (Another plant at Warren, O.)
(a) Light and heavy-gage stampings, light-gage deep-drawn stampings from 20 to 16 gage in sizes to 80 x 160, depth of draw to 22 in.
(b) Washing machine tubs, steel evaporators, and automobile parts.
(c) Assembling facilities.

Murray Corp. of America, 7700 Russell St., Detroit.
(a) Light and heavy sheet metal stampings.
(b) Auto bodies, fenders, hoods, frames, grilles and airplane parts.
(c) Assembling and finishing facilities.

N

Nagel-Chase Mfg. Co., The, 2811-23 N. Ashland Ave., Chicago.
(a) Pressed steel parts to 11 gage and about 20 in. dia.
(b) Pulleys for V-belts, washing machine casters, etc.
(c) Complete facilities.

National Formetal Co., 6539 Metta Ave., Cleveland.
(a) Formed steel, brass and bronze stampings in diameters from $\frac{3}{16}$ in. inside to 5 in. outside lengths to 7 in.
(b) Bushings, spacers, grommetts, ferrules and tubes.
(c) None.

National Stamping Co., 6-30 St. & Jean Ave., Detroit.
(a) Flat, drawn and formed stampings of brass, steel, copper and aluminum up to ¼ in. thick material.
(b) Automotive parts, assemblies and miscellaneous pressed metal parts.
(c) Complete facilities.

New England Pressed Steel Co., Washington Ave., Natick, Mass.
(a) Stampings of steel, brass, copper, stainless steel and aluminum, small and medium.
(b) To customers' specifications.
(c) Heat-treating, finishing and assembling facilities.

New Products Corp., Benton Harbor, Mich.
(a) Flat, drawn and formed stampings of all metals; largest press capacity 125 tons.
(b) Automotive and commercial parts.
(c) Complete facilities.

Noera Mfg. Co., Div. of Chase Brass & Copper Co. Incorporated, Waterbury, Conn.
(a) Medium and light stampings of copper, brass, steel, 14 in. and smaller.
(b) Washers, oilers, etc.
(c) Assembling facilities.

Norris Stamping & Mfg. Co., 5215 S. Boyle Ave., Los Angeles.
(a) All types of sheet metal stampings and deep drawing; ferrous and nonferrous materials; sizes from very small to medium large.
(b) Subcontract stampings of all types.
(c) Complete facilities.

O

O. K. Machine Co. Inc., Fairfield and Poplar Aves., Fort Wayne, Ind.
(a) Stampings from smallest sizes to not exceeding 24 in. overall and not over 6 in. deep, of steel, brass, copper and aluminum.
(b) Laminations, cups, automatic photograph and radio, liquid dispensing pump parts, etc.
(c) Complete facilities.

P

Penn Rivet Corp., Third & Huntingdon Sts., Philadelphia.
(a) Flat, drawn and formed stampings of steel, stainless steel, brass, copper, bronze, aluminum, etc., to 6 in. square and ⅛ in. thick.
(b) Various, for automotive and electrical fields.
(c) Complete facilities.

Paul & Beekman Div., Philadelphia Lawn Mower & Mfg. Co., 4250 Wissahickon Ave., Philadelphia.
(a) Flat, drawn, formed and assembled stampings of steel, copper, brass, aluminum, zinc, bronze, etc.; capacity to 250 tons pressure; to 42 in. by ¼ in. thick material.
(b) Aircraft, Ordnance, Navy, etc.
(c) Complete facilities.

Philadelphia Steel & Wire Corp., Penn St. and Belfield Ave., Philadelphia.
(a) Punch press steel stampings, in all sizes suitable for presses up to 10 tons.
(b) To customers' specifications.
(c) Heat-treating facilities.

Plume & Atwood Mfg. Co., Waterbury, Conn.
(a) Flat, drawn and formed stampings of steel, brass and copper; 12-15 in. draw.
(b) To customers' specifications.
(c) None.

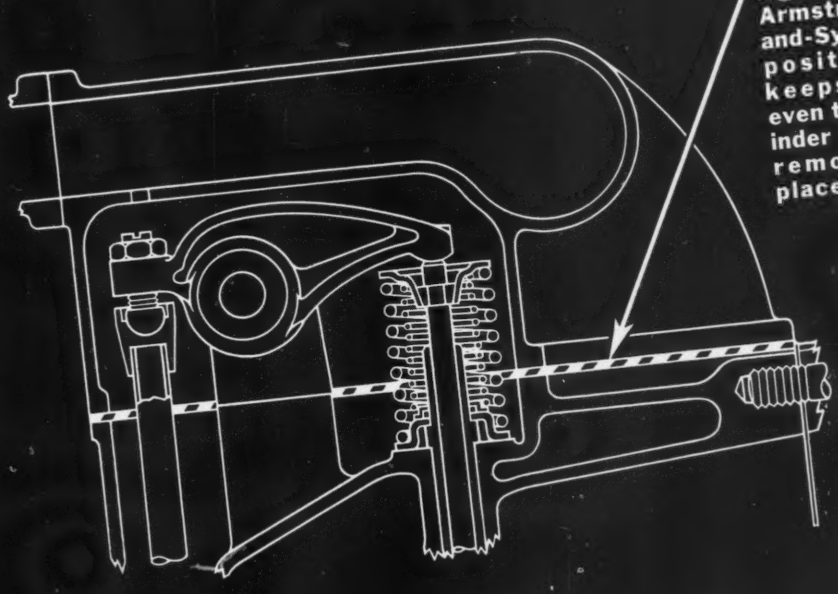
Plymouth Stamped Metal Co., The, 330-334 Harding Way St., Galion, O.
(a) Small stampings.
(b) To customers' specifications.
(c) Complete facilities.

Powell Pressed Steel Co., Hubbard, O.
(a) All types of large or small stampings.
(b) Material handling equipment, automobile, refrigerator, washing machine parts, etc.
(c) Complete facilities.

Publix Metal Goods Corp., 159 W. 25th St., New York.

CASE HISTORY No. 203 FROM OUR GASKETS FILE

PROBLEM: To find a Diesel engine cylinder head cover gasket which would seal hot oil and permit frequent removal of the cover.



A MIDWESTERN manufacturer of Diesel engines had a tough sealing problem. The cylinder head covers on high-speed, lightweight Diesels are frequently lifted and replaced—sometimes as often as two or three times daily. The manufacturer had to find a cylinder head cover gasket which would retain its shape under this tough service condition and keep hot oil from leaking out of the valve rocker arm chamber.

Hence a sealing material was required which would be (1) unaffected by the operating temperatures, (2) impervious to oil, (3) resilient, to maintain a sure seal, (4) nonsticking, to permit easy removal of the covers, (5) compressible without side flow, and (6) nonshrinking.

SOLUTION

The problem was presented to an Armstrong sealing specialist, who analyzed the requirements and recommended an Armstrong's Cork-and-Synthetic Composition (No. DC-100) for the job. Gaskets made of this material are now giving trouble-free service in thousands of Diesel engines.

SEALING SPECIALISTS AT YOUR SERVICE

If a sealing problem has you stumped right now, send it to Armstrong's sealing specialists. They can give you unbiased recommendations, because there are more than fifty specialized sealing materials in the Armstrong Line . . . providing virtually any desired physical properties. Included are many different cork compositions and more than thirty synthetic, cork-and-synthetic, and cork-and-rubber compositions . . . available in rolls, sheets, cut gaskets, and molded or extruded shapes. In addition, Armstrong makes No. 841 Fibrated Leather, a general-purpose gasket material offering the advantages of natural leather in large, uniform, low-cost rolls and sheets.

For quick service, send an assembly print illustrating your problem, with a letter giving full details about your requirements, to Armstrong Cork Company, Industrial Division, 942 Arch Street, Lancaster, Pa.

ARMSTRONG'S
GASKETS · SEALS
PACKINGS

Cork Compositions
*Cork-and-Synthetics • Synthetics
Cork-and-Rubber • Fibrated Leather

*FORMERLY "CORPRENE"

(a) Flat stampings, deep-drawn and multiple formings in all metals; 10 in. blanks to ¼ in. thick.
(b) To customers' specifications.
(c) Complete facilities.

Q

Quadriga Mfg. Co., The, 213 W. Grand Ave., Chicago.
(a) Flat and drawn stampings of steel, brass and alloy materials; 125-ton capacity.
(b) Customers' specifications.
(c) None.

R

Raymond Mfg. Co., Div. Associated Spring Corp., Corry, Pa.
(a) Small stampings of steel, brass, phosphor bronze, Monel, etc.
(b) Springs, wire forms, etc.
(c) Heat treating facilities.

Reliable Spring Co., The, 3167 Fulton Rd., Cleveland.
(a) Blanking, forming, cutting of wire and strip in steel, stainless steel, brass, phosphor bronze, etc., flats $\frac{1}{16}$ in. thick x 4 in. dia. and wire .006 in. to ⅜ in. dia.
(b) Springs, wire formations, bends, hooks, handles, clips, etc.
(c) Heat treating and assembling.

Res Mfg. Co., 2915 W. Meinecke Ave., Milwaukee.
(a) Formed stampings of wire, hot and cold-rolled, brass and bronze in small sizes.
(b) War subcontract work.
(c) Information not available.

Revere Products Corp., Phoenix, N. Y.
(a) Blanking, forming or drawing from light metals, steel, bronze, copper, stainless steel, aluminum, and brass, blanking to ¼ in. thick, forming to 36 in. long, drawing to 4 in. deep.
(b) Oil retainers, washers, escutcheons, etc.
(c) Complete facilities.

Rockford Metal Specialty Co., 716 Cedar St., Rockford, Ill.
(a) Drawing, forming, piercing of steel, stainless steel, aluminum, brass and zinc, approx. 10 in. dia. x 3½ in. cups; up to 16 in. dia. or sq. on shallow parts.
(b) Automotive and general stamping.
(c) Plating, riveting, welding, assembling and enameling.

Rockwood Sprinkler Co., 52 Harlow St., Worcester, Mass.
(a) Medium-heavy deep drawing and stamping of brass. bronze, hot and cold-rolled steel, .02-.375 in. thick, 1-12 in. blank dia.
(b) Handles, pipe unions, textile, electrical and automatic machine parts.
(c) Machining, sherardizing, parkerizing facilities.

Rome-Turney Radiator Co., Canal St., Rome, N. Y.
(a) Copper, brass and steel stampings in sizes 15 x 30 x 6 in. deep.
(b) Refrigeration air heating and cooling.
(c) Gas and spot welding, machining.

S

Scovill Mfg. Co., Waterbury, Conn.
(a) Brass. bronze, nickel silver, copper, aluminum, steel, and other metal stampings, drawn shells, formed parts and metal assemblies, nonferrous forgings.
(b) To customers' specifications.
(c) Complete facilities.

Service Products Corp., 201 South Rural St., Indianapolis.
(a) Blanking, forming, drawing, perforating, both heavy and light, of steel, brass aluminum, copper and bronze; draw 6 in. deep, blanking 28 x 36 in.
(b) Automotive fans, ventilators, etc.
(c) Heat treating and machining.

Shunk Mfg. Co., Bucyrus, O.
(a) Blanking, forming and perforating, all types of materials.
(b) To customers' specifications.
(c) Complete facilities.

Stanley Works, The, Pressed Metal Div., New Britain, Conn.
(a) Flat, drawn and formed stampings of steel, brass, bronze and aluminum in all sizes.
(b) Various.
(c) Complete facilities.

Steel Stamping Co., The, 3553 Broadway, Lorain, O.
(a) Flat, deep-drawn, formed, etc. stampings of steel or other metals in all sizes.
(b) Various.
(c) Complete facilities.

Stolper Steel Products Corp., 3258 W. Fond du Lac Ave., Milwaukee.
(a) All types of sheet metal up to quarter inch.
(b) For automotive, agricultural, and industrial fields.
(c) Complete assembling facilities, welding.

T

Textile Shield Co., Groton St., Lawrence, Mass.
(a) All kinds, up to $\frac{1}{16}$ in. thick, specializing in deep drawn work.
(b) Radio and auto parts, ferrules, etc.
(c) Annealing facilities.

Transue & Williams Steel Forging Corp., Alliance, O.
(a) Medium-sized stampings, blanked, formed, pierced and drawn, from hot and cold rolled steel, stainless steel, aluminum and Monel metal.
(b) All sizes and types of parts.
(c) Welding, brazing, punching and riveting.

Truscon Steel Co., Pressed Steel Division, 6100 Truscon Ave., Cleveland.
(a) From 20-gage to heavier gage stampings.
(b) Refrigerator, automotive, housings, washing machine, etc.
(c) None.

W

Wallace Barnes Co., Div. of Associated Spring Corp., Bristol, Conn.
(a) Flat and formed stampings of spring steel, stainless and alloys in small sizes.
(b) Various.
(c) Heat-treating facilities.

Western Cartridge Co., East Alton, Ill.
(a) Brass, bronze, phosphor bronze, nickel silver, sheets, strips, coils.
(b) To customers specifications.
(c) Information not available.

Whitehead Stamping Co., 1661 W. Lafayette Blvd., Detroit.
(a) Light, medium and heavy stampings.
(b) S.A.E. standard, U. S. standard, steel and brass washers.
(c) Complete facilities

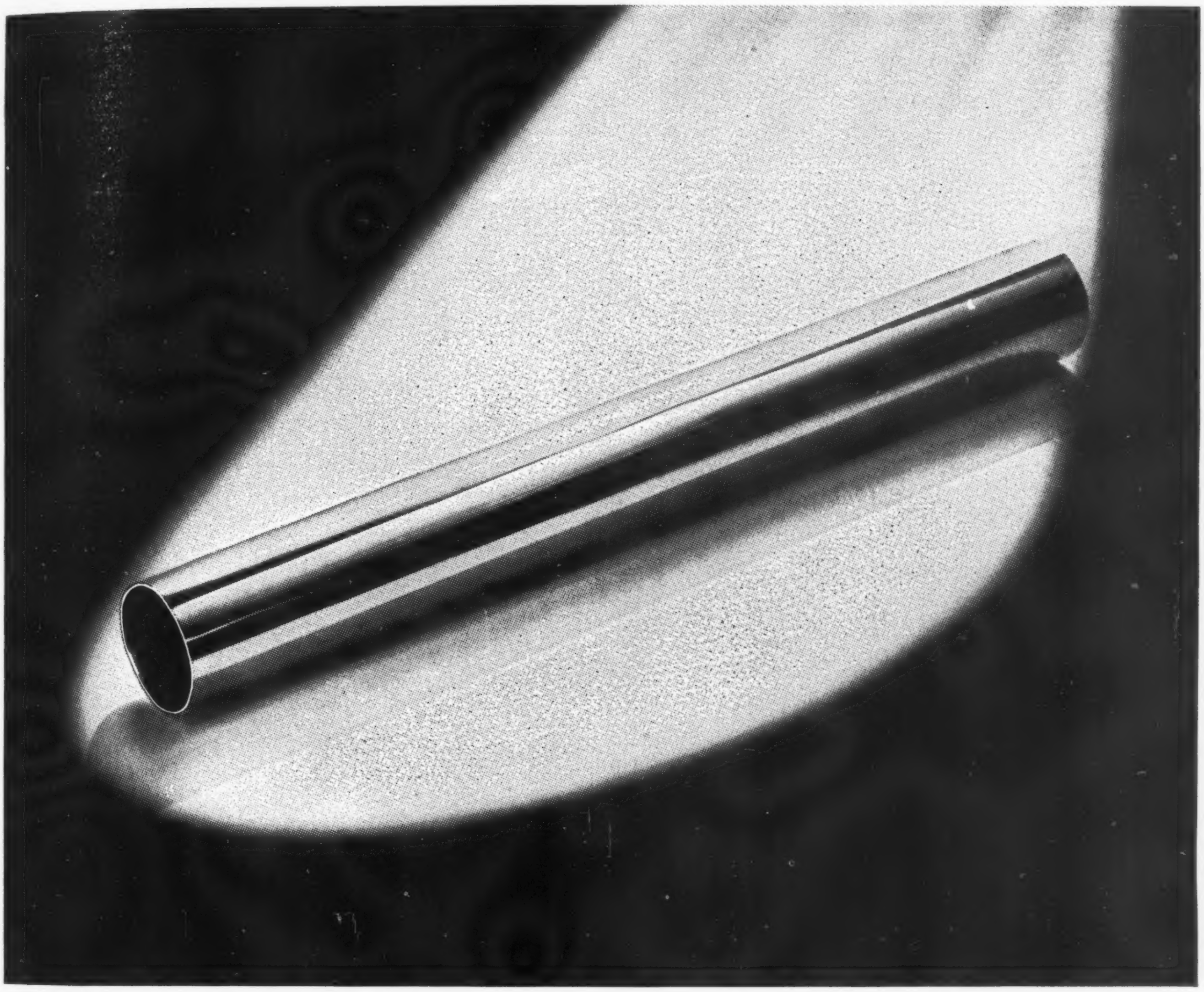
Williams, H. E., Products Co., 100-122 S. Main St., Carthage, Mo.
(a) Light stampings, sheet metal fabrication, steel and nonferrous metals, press size to 80 tons capacity.
(b) Automotive, electrical fluorescent light fixtures, etc.
(c) Turret lathes, screw machines, spot welders, plating, ovens for baking finishes.

Woodworth Specialties Co., 239 Water St., Binghamton, N. Y.
(a) Flat, shallow drawn, formed and punched stampings of steel, copper, brass, nickel, monel, stainless steel, nickel silver, aluminum, etc., in sizes requiring presses to 30 tons capacity.
(b) Electric terminals, shallow cups and collars, disks, rings, ferrules, etc.
(c) Machining and assembling facilities.

Worcester Pressed Steel Co., 111 Barber Ave., Worcester, Mass.
(a) Pressed metal stampings of any metal or alloy from ½ in. to 4 ft. dia., in lengths to 7 ft., using material from .002 to ½ in. thick, cold forgings at 1000 tons pressure.
(b) Automotive, airplane, oil burner, vacuum cleaner, transmission parts, etc.
(c) Complete facilities.

Worcester Stamped Metal Co. Inc., 9 Hunt St., Worcester, Mass.
(a) Light and heavy stampings of steel, brass, aluminum, copper and stainless steel, large and small.
(b) To customers' specifications.
(c) Annealing and hardening facilities.

Wrought Washer Mfg. Co., 2102 S. Bay St., Milwaukee.
(a) Stampings, blanking, forming, drawing, extruding, in all ferrous and nonferrous metals. Presses 300 ton capacity; material up to 1¼ in. thick.
(b) Washers, expansion plugs, automotive, etc.
(c) Complete facilities.



Investigate "GLOWELD" . . . THE NEW

GLOBE WELDED STAINLESS STEEL TUBING

. . . Gloweld is the result of a long period of research and experiment by the Globe Steel Tubes Co., pioneer manufacturer of stainless steel tubing.

It is produced by a closely controlled electric welding process that gives it unusually smooth finish — "flash" is hardly detectable. Gloweld's light weight, high resistance to corrosion, heat and pressure, comparatively lower cost, and other advantages will find many applications for tubing in chemical and process industries, food industries, pulp and paper, oil and other industries where these factors are needed. It is already in use in aircraft construction — as hydraulic lines, and for engine parts. Available in a wide range of diameters and wall sizes, in practically all stainless steel analyses. Write for full information.

GLOBE STEEL TUBES CO • MILWAUKEE, WISCONSIN

GLOBE TUBES

- Stainless Tubes
- Boiler Tubes
- Condenser and Heat Exchanger Tubes
- Mechanical Tubing

GLOBE STEEL TUBES

4000

Forgings Producers

Reference letters beneath addresses of companies refer to: (a) Types, materials and sizes of forgings; (b) Names of forged machine parts customarily produced; and (c) Machining or heat-treating facilities.

A

Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh.
(a) Disks to 24 in. dia. x 5 in. thick; also special shapes; of high-speed steels, alloy and carbon tool steels, stainless and Nitralloy.
(b) Hardened machine parts, etc.
(c) Complete facilities.
See advertisement, Page 99

Alliance Drop Forging Co., P. O. Box 427, Alliance, O.
(a) Small drop forgings.
(b) To customers' specifications.
(c) Treated and shot blasted, not machined.

Aluminum Company of America, Gulf Bldg., Pittsburgh.
(a) Aluminum and magnesium alloy hammered and pressed forgings, in any sizes.
(b) Largely aircraft and aircraft engine parts.
(c) Heat-treating facilities.

American Brass Co., Waterbury, Conn.
(a) Hot-pressed copper, brass, bronze, nickel, silver, and special copper alloys in small sizes and shapes.
(b) To customers' specifications.
(c) None.
See advertisements, Pages 92-93

American Chain Div., American Chain & Cable Co. Inc., First St., Braddock, Pa.
(a) SAE 1015-SAE 1045 drop forgings; 2 oz.-42 lb.
(b) Grab and sling hooks, shackles, chain hoist parts, brake levers, bent and drop-forged eyebolts up to and including 1½ in.
(c) None.

American-Forge Div., 2621 S. Hoyne Ave., Chicago.
(a) Drop and upset forgings, of alloy and carbon steel.
(b) To customers' specifications.
(c) Complete heat-treating facilities.
See advertisement, Page 179

American Hollow Boring Co., Erie, Pa.
(a) Hollow-bored forgings.
(b) Spindles, hydraulic cylinders, piston rods, clutch shafts, etc.
(c) Information not available.
See advertisement, Page 193

American Magnesium Corp., 2210 Harvard Ave., Cleveland.
(a) Hammered and pressed forgings, of magnesium alloys, in any size.
(b) To customers' specifications.
(c) Heat-treating facilities.
See advertisement, Page 165

Ampco Metal Inc., 1745 S. 38th St., Milwaukee, Wis.
(a) All practical sizes, in copper base alloys.
(b) Aircraft parts and engines, machine tool, heavy machinery and chemical equipment.
(c) Complete facilities.
See advertisement, Page 88

Atlas Drop Forge Co., 209 W. Mount Hope Ave., Lansing, Mich.
(a) All sizes and shapes, any material, from few ounces to 500 lb.
(b) Farm implements, tractors, railroad, aviation, automotive, etc.
(c) Complete heat-treating facilities.

Atwater Mfg. Co., Plantsville, Conn.
(a) Drop and upset forgings of steel up to 20 lb.
(b) To customers' specifications.
(c) Heat treatment.

B

Benton Harbor Malleable Industries, Benton Harbor, Mich.
(a) Drop hammer steel forgings to 80 lb.
(b) To customers' specifications.
(c) Complete facilities.

Bethlehem Steel Co., Bethlehem, Pa.
(a) Open die forgings to 225,000 lb. in all grades of carbon and alloy steels—solid and hollow. Drop forgings from 1 to 350 lb. Also upset forgings.
(b) Shafts, rotors, rolls, gears and other press and hammer forgings.
(c) Complete facilities.

Billings & Spencer Co., The, 1 Laurel St., Hartford, Conn.
(a) All types in brass, bronze, stainless steel, alloys, straight carbon steel, Monel metal and tool steel; to 100 lb.
(b) Airplane, automobile, machine tool parts, gas and diesel engine, conveyor, mining machinery, typewriter parts, etc.
(c) Complete facilities.

Bohn Aluminum & Brass Corp., 1400 Lafayette Bldg., Detroit, Mich.
(a) Hot-pressed brass and aluminum forgings up to 15 lb. in brass and up to 10 lb. in aluminum, depending upon the design.
(b) To customers' specifications.
(c) Heat-treating facilities.

Bonney Forge & Tool Works, Allentown, Pa.
(a) Drop forgings from 1 oz. to 8 lb. of any grade steel, alloy or carbon; also small upset forgings.
(b) Machine handles, etc.
(c) Complete facilities.

Brewer-Titchener Corp., 111 Port Watson St., Cortland, N. Y.
(a) Ferrous, drop and upset forgings up to 28 lb.
(b) Automotive and custom drop forgings.
(c) Complete facilities.

Buckeye Forging Co., 10001 Harvard Ave., Cleveland.
(a) Small forgings of carbon and alloy steels, stainless steels, brass and copper.
(b) Automotive, tractor, tank, etc.
(c) Machining facilities.

C

Canton Drop Forging & Mfg. Co., Canton.
(a) Drop, upset, rolled and hammered forgings in steel only, up to 600 lb. each.
(b) Parts for aircraft engines, propellers, planes, automotive cars and trucks.
(c) Complete heat treating.

Cape Ann Tool Co., 146 Granite St., Pigeon Cove, Mass.
(a) All types and sizes of drop anl upset forgings in ferrous and nonferrous metals.
(b) To customers' specifications.
(c) Heat-treating facilities.

Capewell Mfg. Co., 60 Governor St., Hartford, Conn.
(a) Drop and hand forgings in steel and nonferrous metals, 7 lb. or less.
(b) Gears, levers, valves, or any part to specification.
(c) Complete heat treating and cleaning facilities.

Carnegie-Illinois Steel Corp., 434 Fifth Ave., Pittsburgh.
(a) All type forgings produced with open dies, in all types of steel. Round—body diameter 68 in., max. collar diameter, 90 in., max. weight 220,000 lb. Rectangular—up to 30 in. max. thickness, 150 in. max. width, with max. weight of 220,000 lb. Hollow rounds—max. outside diameter 140 in.
(b) Axles, bars, bridge pins, hexagon shafts, propeller shafts, rotors, locomotive parts, back-up rolls, sleeves, pinions, reduction gears, mill housings, etc.
(c) Complete facilities.

Carpenter Steel Co., The, 120 Bern St., Reading, Pa.
(a) Simple forgings made on flat dies in all SAE, stainless and tool steels up to 3000 lb.
(b) Rings, disks, blocks, simple shafts, axles, etc.
(c) All heat treating facilities; minimum of machine work.
See advertisements, Pages 96-97

Champion Machine & Forging Co., 3695 E. 78 St., Cleveland.
(a) All type steel drop forgings to 3000 lb.
(b) To customers' specifications.
(c) Heat-treating facilities.

Chase Brass & Copper Co. Incorporated, 236 Grand St., Waterbury, Conn.
(a) Brass, naval brass, copper and copper alloy, and Olympic bronze.
(b) Automotive, aircraft, refrigeration parts, air valves, etc.
(c) Annealing, machining, polishing and plating facilities.

Clapp, E. D., Mfg. Co., 305 Genesee St., Auburn, N. J.
(a) Drop forgings of carbon, stainless steel, Monel, brass, bronze, copper, etc.
(b) Aircraft, automotive, railroad, tractor, etc.
(c) Complete facilities.

Cleveland City Forge Co., 4501 Lakeside Ave., Cleveland.
a) Drop and upset forgings of carbon and alloy steel, from few ounces to several hundred pounds.
(b) To customers' specifications.
(c) Complete facilities.

Cleveland Hardware & Forging Co., 3270 E. 79th St., Cleveland.
a) Drop and upset forgings in steel and brass.
(b) To customers' specifications.
(c) Complete facilities.

Clifford-Jacobs Forging Co., Box 264, Champaign, Ill.
(a) Drop forgings.
(b) Steel flanges, center plates, wedges, hubs, gears, connecting rods.
(c) Information not available.

Columbus Forge & Iron Co., The, 544 W. First Ave., Columbus, O.
(a) Steel alloy and plain carbon drop forgings; from ½ to 150 lb.
(b) Automobiles, trucks, road and mining machinery, artillery, aircraft, tanks, etc.
(c) Semifinishing, normalizing and annealing.

Cornell Forge Co., 1659 W. 74th St., Chicago.
a) All type drop forgings, from fraction of

★

ACKNOWLEDGMENT

★

MACHINE DESIGN takes this opportunity of thanking all those companies and individuals who cooperated in the compilation of the Tenth Annual Edition of the Directory of Materials bound into the center of this issue. We are particularly indebted to the manufacturers of the materials for their response to requests for information on their products, and to the advertisers whose collaboration made possible the presentation.

★

an ounce to 15 lb.; carbon steel, Monel, stainless steel, etc.
(b) Cams, crankshafts, pins, gears, hubs, valves, connecting rods, and war products.
(c) Annealing and shot blasting.

Crucible Steel Co. of America, 405 Lexington Ave., New York.
(a) All types of forgings in carbon and alloy grades, to 40 tons max. weight.
(b) Crankshafts, propeller shafts, piston rods, rams, gun forgings, rings, disks, etc.
(c) Complete facilities.

D

Davenport Besler Corp., 2305 Rockingham Rd., Davenport, Ia.
(a) Drop forgings and open steam hammer forgings.
(b) Crankshafts, connecting rods, levers, automotive and railway equipment.
(c) Complete facilities.

Dayton Forging & Heat Treating Co., The, 2323 E. First St., Dayton, O.
(a) Flat die forgings of SAE steel in all sizes up to 30 in. diameter and 16 ft. long on bars up to 12 in. diameter or 16 in. bars up to 6 ft. long.
(b) Collets, bars, shafts, gear blanks, rings, bushings and spindles.
(c) Complete facilities.

Delaware Alloy Forge Co., 2300 E. Tioga St., Philadelphia.
(a) Flat die steam hammer work in stainless steel, tool steel, Nitralloy, Monel metal, bronze and other alloys from 1 to 5000 lb.
(b) Seat rings for large valves, knitting machine cylinders, paper machinery shafts, and gears.
(c) Complete facilities.

Dow Chemical Co., The, Midland, Mich.
(a) Magnesium alloy forgings.
(b) To customers' specifications.
(c) Heat treating facilities.

Drop Dies & Forgings Co., 3097 E. 61st St., Cleveland.
(a) Drop forgings up to 25 lb.
(b) To customers' specifications.
(c) Heat-treating facilities.

Dyson & Sons, Joseph, Inc., 5125 St. Clair Ave., Cleveland.
(a) Steel and aluminum hammered forgings in 15 to 2000 lb.
(b) Shafts, die blocks, spindles, weldless rings, gear blanks, bars, etc.
(c) Complete facilities.

E

Ellwood City Forge Co., Box 590, Ellwood City, Pa.
(a) Steel forgings, 25 to 35,000 lb.
(b) Crankshafts for aircraft, automobile, gas, steam, or diesel engines.
(c) Complete facilities.

Endicott Forging & Mfg. Co. Inc., Endicott, N. Y.
(a) Drop and upset forgings, of carbon and alloy steels, Monel, stainless, Nitralloy, brass, copper and bronze, from 2 oz. to 80 lb.
(b) Gear blanks, crankshafts, connecting rods, rocker arms, etc.
(c) Heat-treating facilities.

Erie Forge Co., Erie, Pa.
(a) Flat die, press and hammered steel forgings.
(b) Marine and stationary engine crankshafts, etc.
(c) Complete facilities.

F

Falleen Drop Forge Corp., Filer City, Manistee Co., Mich.
(a) Steam hammer and upset forgings in carbon and alloy steels, ½ to 45 lb.
(b) To customers' specifications.
(c) Heat-treating facilities.

Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago.
(a) Hammer and press forgings in carbon and alloy steels from 5-50,000 lb.
(b) Shafts, rolls, rings, gear and pinion blanks, etc.
(c) Complete facilities.

Forging & Casting Corp., The, 1350 Jarvis Ave., Ferndale, Mich.
(a) Smooth hammered forgings, of S.A.E. grades of steel, ½ lb.-1500 lb.
(b) Rings, blocks, disks, and irregular shapes.
(c) Annealing facilities.

Forgings & Stampings Inc., 23rd Ave. and Seventh St., Rockford, Ill.
(a) Drop forgings.
(b) To customers' specifications.
(c) Information not available.

G

Gardiner Mfg. Co., 2707 Union St., Oakland, Calif.
(a) Drop forgings up to 2 lb. and also hammer and upset forgings.
(b) Gearshift levers, bolts, etc.
(c) Machining facilities.

General Drop Forge Div., Brown-Lipe Gear Co., 1738 Elmwood Ave., Buffalo.
(a) Drop-forged and upset forgings, of carbon, stainless, Monel and other alloys, 1 oz.-100 lb.
(b) Rings, gears, stem pinions, side gears, connecting rods, etc.
(c) Heat-treating facilities.

Globe Forge & Foundries Inc., Peat Street, Syracuse, N. Y.
(a) Drop and upset forgings in carbon and alloys from few ounces to 125 lb.
(b) Differential, transmission gears.
(c) Complete facilities.

H

Hammond & Irving Inc., 254 North St., Auburn, N. Y.
(a) Steam hammer forgings in alloy and tool steels, stainless, Nitralloy and Monel metals, up to 1200 lb.
(b) Weldless rings, gear blanks, shafts, hammered bars, etc.
(c) Complete facilities.

Harris-Thomas Drop Forge Co., 126 Harshman St., Dayton, O.
(a) Drop forgings.
(b) To customers' specifications.
(c) Information not available.

Harrisburg Steel Corp., 10th and Herr Sts., Harrisburg, Pa.
(a) Alloy and carbon open-hearth steel drop forgings which can be produced on steam drop hammers from 2000-8000 lb.
(b) All types of machine parts.
(c) Complete facilities.

Harvey Spring & Forging Co., 17th & Murray Sts., Racine, Wis.
(a) Carbon and alloys, steel drop hammered forgings in ¼-10 lb.
(b) Various machine parts.
(c) None.

Henry & Allen Inc., 2-36 Wadsworth St., Auburn, N. Y.
(a) Drop and hammered forgings of carbon and alloy steel, under 1 lb. to 12 lb.
(b) Agricultural, automobile and commercial.
(c) Complete heat-treating facilities.

Heppenstall Co., 4622 Hatfield St., Pittsburgh.
(a) Forgings of carbon, alloys, and steels, up to 45,000 lb. rough turned weight.
(b) Shafts, crankshafts, die blocks, shear knives, rolls, etc.
(c) Complete facilities.

Herbrand Corp., Fremont, O.
(a) Drop forgings.
(b) Automobile, etc.
(c) Heat-treating facilities.

I

Indiana Forge & Machine Co., Indiana Harbor Station, East Chicago.
(a) Steel drop forgings up to 4 lb.
(b) Clutch hubs.
(c) Information not available.

Indianapolis Drop Forging Co., 1300 Madison Ave., Indianapolis.
(a) Hammered and drop forgings in steel, carbon, alloy and stainless up to 50 lb. drop, 500 lb. hammered.
(b) To customers' specifications.
(c) Complete facilities.

Interstate Drop Forge Co., 4041 N. 27th St., Milwaukee.
(a) Drop and upset forgings of carbon, alloy and stainless steel.
(b) Levers, gears, segments, hydraulic fittings, connecting rods, crankshafts, etc.
(c) Heat-treating facilities.

J

Jersey Forging Works, 803 Jersey Ave., Jersey City, N. J.
(a) Alloy steel and Standard SAE steel forgings.
(b) Gear blanks, rings, sleeves, rolls, shafts, spindles, etc.
(c) Complete facilities.

Johnston & Jennings Co., 877 Addison Rd., Cleveland.
(a) Flat die forgings in plain carbon and alloy steels, 1 lb. to 5 tons.
(b) Spindles, solid and hollow-bored; rings, arbors, shafts, gears, etc.
(c) Complete machine shop facilities.

K

Keystone Forging Co., Northumberland, Pa.
(a) Drop forgings of steel, brass and other alloys not exceeding 3 lb.
(b) To customers' specifications.
(c) Complete facilities.

Koppers Co., Bartlett Hayward Div., 200 Scott St., Baltimore, Md.
(a) D-H-S bronze and steel-hammered forgings up to 40 carbon in 2-8 in. rounds.
(b) To customers' specifications.
(c) Complete facilities.

Kortick Mfg. Co., 345 First St., San Francisco.
(a) Drop forgings.
(b) Bolts, nuts, washers, etc.
(c) Information not available.

Kraeuter & Co. Inc., 585 Eighteenth Ave., Newark, N. J. (Drop Forging Div., Nye Ave. and S. Twentieth St., Irvington, N. J.)
(a) Closed die and upset forgings, of carbon, Monel, stainless steel, bronze and alloy steels, ½ oz. to 20 lbs.
(b) To customers' specifications.
(c) Limited facilities.

Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago.
(a) Steam hammer to 20 tons; drop and upset.
(b) To customers' specifications; merchant bars, die blocks, flanges.
(c) Machining, heat treating, Magnaflux inspection.
See advertisement, Page 89

L

Lakeview Forge & Clevis Co., Pittsburgh Ave., Erie, Pa.
(a) Drop forgings up to 10 lb. in alloy or carbon steel.
(b) To customers' specifications.
(c) Heat-treating facilities.

Lamson & Sessions Co., The, Cleveland, Kent, Chicago and Birmingham, Ala.

COMPILED
FOR YOUR REFERENCE!

★

These pages represent the Tenth edition of the Directory of Materials. Presented as an integral part of the October, 1942, issue of MACHINE DESIGN, it is written and compiled for design executives in the machinery manufacturing field with the express purpose of bringing together factual information that will aid them in their daily problems.

To serve readers most effectively the Directory has been carefully divided in sections covering those phases of engineering materials required to meet today's needs which have been complicated by war shortages, delayed delivery dates, etc. The listings are keyed to provide instant selection by identification of principal properties.

With the editorial contents compiled and edited to assist designers of machinery in selecting the best possible material to meet their requirements, the Supplement will find immediate acceptance and use. The editorial pages as well as the advertising section constitute a veritable "Where-To-Buy" Directory.

Like MACHINE DESIGN's previously-published "Machine Drives and Controls" Supplement and other special features covering specific phases of design, this new edition of the Directory of Materials adds another valuable reference work to the engineer's library.

MACHINE DESIGN

The Professional Journal of Chief Engineers and Designers

Covers every size and type of machinery---from the "Wristwatch to the Locomotive"

(a) Small hot and cold upset forgings of any metal or alloy.
(b) Bolts, nuts, cotters, cap screws and special hot and cold upset products.
(c) Complete facilities.

Lansing Drop Forge Co., Logan and Albert Sts., Lansing, Mich.
(a) Drop forgings to 80 lb., upset forgings, coined and machined forgings, of all grades of carbon, Monel metal, aluminum and other alloys, from 2 oz. to about 80 lb.
(b) Steering arms, shift levers, small crankshafts, camshafts, shock absorber arms, rocker arms, gears, housings, etc.
(c) Complete facilities.

Larson, Charles E., & Sons Inc., 2645 N. Keeler Ave., Chicago.
(a) Large and small hammered forgings in iron and steel, high-carbon, high-chrome and other alloys.
(b) Miscellaneous parts.
(c) Complete facilities.

Latrobe Electric Steel Co., Latrobe, Pa.
(a) High speed steel and stainless steel forgings, blocks approx. 16 in. cube, flats approx. 20 x 10.
(b) Shear blades, disks, etc.
(c) Heat-treating facilities.

Leard, William, Co. Inc., New Brighton, Pa.
(a) Hammered and hydraulic pressed steel forgings up to 25,000 lb.
(b) Crankshafts, connecting rods and other type forged steel shafts.
(c) Complete facilities.

Letts Drop Forge Inc., 2714 W. Jefferson Ave., Detroit.
(a) Small and medium drop forgings in carbon and alloy bar stock.
(b) Automotive parts.
(c) None.

Lindell Drop Forge Co., S. Logan and N. Y. C. R. R., Lansing, Mich.
(a) Carbon and alloy steel forgings, from 1 oz. to 50 lb.
(b) For automotive, agricultural, mining machinery, etc.
(c) Limited machining.

M

Machinery Forging Co., The, 5450 Hamilton Ave., Cleveland.
(a) Flat die forgings of carbon and alloy steels, 1-2000 lb.
(b) Rings, disks, blocks, spindles, bars, hubs, etc.
(c) Rough turning only.

Manganese Steel Forge Co., Richmond St. & Castor Ave., Philadelphia.
(a) Upset and pressed forgings in 11-14 per cent manganese steel up to 50 lb.
(b) Headed pins.
(c) Complete facilities.

Melling Forging Co., 1401 Case St., Lansing, Mich.
(a) Steel drop forgings; from 1 oz. to 8 lb.
(b) To customers' specifications.
(c) Complete facilities.

Merrill Brothers, 56 Arnold Ave., Maspeth, Queens, N. Y.
(a) Drop forgings of steel and alloys, from fraction of oz. to 100 lb. or more.
(b) Turnbuckles, clevis nuts, shackles, eyebolts, hexagon sleeve nuts, etc.
(c) Complete facilities.

Mesta Machine Co., Box 1466, Pittsburgh.
(a) Very large steel and alloy steel forgings, both hollow and solid.
(b) Shafts, pinions, rolls, high pressure cylinders and reaction vessels.
(c) Complete facilities.

Midvale Co., The, Nicetown, Philadelphia.
(a) Press or hammer forgings, solid or hollow, in carbon or alloy steel.
(b) All types of parts.
(c) Complete facilities.

Milwaukee Forge & Machine Co., 1532 E. Oklahoma Ave., Milwaukee, Wis.
(a) Open-frame and drop-hammered forgings and weldless rolled steel rings in carbon and alloy steel, any size.
(b) Crankshafts, hub forgings, axles and weldless (seamless) rolled rings.
(c) Complete facilities.

Mitchell Steel Co., The, Stockyards Station, Cincinnati.
(a) Steam hammer forgings in plain carbon alloy and stainless steel.
(b) All types of machine parts, railroad, marine, etc.
(c) Complete facilities.

Modern Die & Drop Forge Co., 2600 W. 139th St., Blue Island, Ill.
(a) Drop forgings.
(b) To customers' specifications.
(c) Information not available.

Mondie Forge Co. Inc., 10300 Berea Rd., Cleveland.
(a) Drop forgings up to 75 lb., upset forgings to 4 in., also gear blanks.
(b) To customers' specifications.
(c) Machining facilities.

Moore Drop Forging Co., 36 Walter St., Springfield, Mass.
(a) Drop, upset and coined forgings.
(b) To customers' specifications.
(c) Heat treating and machining.

Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
(a) Drop hammered and pressed forgings in brass, bronze, copper, aluminum and alloys; 1 oz.-25 lb.
(b) To customers' specifications.
(c) Complete facilities.
See advertisement, Page 108

N

National Forge & Ordnance Co., Irvine, Warren Co., Pa.
(a) Flat die press and hammered steel forgings.
(b) Heavy-duty crankshafts, etc.
(c) Complete facilities.
See advertisement, Page 193

National Lock Washer Co., 40 Hermon St., Newark, N. J.
(a) Small drop forgings.
(b) Steel rod ends in adjustable yoke, plain yoke and eye types; steel clevis pins for steel rod ends; steel plugs, rings, and flanges, all in standard sizes, etc.
(c) Heat treating and machining.

O

Octigan Forge & Mfg. Co., 2428 S. Lowe Ave., Chicago.
(a) Drop forgings.
(b) To customers' specifications.
(c) None.

Ohio Forge & Machine Corp., 3010 Woodhill Rd., Cleveland.
(a) Drop, upset and flat hammer steel forgings in all sizes.
(b) Precision gears, all type spline shafts, power transmitting equipment.
(c) Complete heat treating, machining for gears and shafts only.

O'Leary & Son Co., Arthur J., 5757 West 65th St., Chicago.
(a) Upset and hammered forgings of medium and mild steels and alloys to 5 in. dia. upsetting and to 10 in. dia. steam hammer.
(b) Gear blanks, special bolts, upset rods, stampings, welded assemblies and fabricated steel parts.
(c) Information not available.

Oliver Iron & Steel Corp., N. E. Corner S. 10th and Muriel Sts., Pittsburgh.
(a) Small forgings in iron, steel and alloys in sizes of 8 in., and weight of 5 lb. Large and small upset bars.
(b) Bolts, nuts, rivets, hot or cold headed special parts of all kinds.
(c) Complete facilities.

Owensboro Forging Co., Owensboro, Ky.
(a) Drop forgings.
(b) To customers' specifications.
(c) Heat treating facilities.

P

Pacific Car & Foundry Co., Renton, Washington.
(a) Hammered, drop and upset forgings of steel; up to 8 in.
(b) Gears, pistons, connecting links, etc.
(c) Complete facilities.

Park Drop Forge Co., The, 730 E. 79th St., Cleveland.
(a) All types of drop steel forgings up to 4000 lb. each.
(b) Crankshafts, connecting rods, camshafts, axles, gears, etc.
(c) Complete machining, heat treating.

Pettibone Mulliken Corp., 4710 W. Division St., Chicago.
(a) Drop, hammer and upset forgings in alloy and carbon steels, from 1 oz. to 20 lb.
(b) Automotive and railroad parts.
(c) Limited machining and heat treating.

Phoenix Mfg. Co., Front & Chapel Sts., Catasauqua, Pa.
(a) Drop forgings up to 35 in.
(b) Journals, yokes, welding flanges, clevises, also commercial forgings of various types and designs.
(c) Machining facilities.

Pittsburgh Forgings Co., Coraopolis, Pa.
(a) Drop and upset forgings, from 1 oz. to 350 lb.
(b) Automotive, tractor, farm implement, railroad car, machine tool parts, and gear blanks.
(c) Complete facilities.

Pittsburgh Forgings Co., Riverside Div., Jackson, Mich.
(a) Drop forgings, from 3-50 lb.
(b) Specialty, automotive hubs and tractor wheels.
(c) Complete facilities.

Pittsburgh Trolley & Forge Co., 117 Water St., Pittsburgh.
(a) Forgings in carbon and alloy steels, up to 2000 lb.
(b) Spindles, shafts, gears, rings, etc.
(c) Complete facilitiies.

Poor & Co., Canton Forge & Axle Works, 2027 Dueber Ave., S. W., Canton, O.
(a) Drop die and upset forgings in carbon and alloy steels, from 1-350 lb.
(b) Spindles, levers, gears, etc.
(c) Heat-treating facilities.

Porter Forge & Furnace Inc., 6 Ashland St., Everett, Mass.
(a) Drop forgings of standard and special steels and metals.
(b) To customers' specifications.
(c) Complete heat-treating facilities.

Portland Forge & Fdry. Co., Portland, Ind.
(a) Board hammer, upset forgings of steel bars, up to 60 lb.
(b) Gears, etc.
(c) Complete facilities.

R

Revere Copper & Brass Inc., 230 Park Ave., New York.
(a) Die pressed and hammered forgings, of brass, bronze, copper, nickel silver, cupronickel, silicon bronze (Herculoy), aluminum and magnesium.
(b) To customers' specifications.
(c) Complete facilities.

Rockford Drop Forge Co., 1033 Ninth St., Rockford, Ill.
(a) Drop forgings.
(b) Automotive and industrial clutches, etc.
(c) Information not available.

Rome Mfg. Co. Div., Revere Copper & Brass Inc., Railroad St., Rome, N. Y.
(a) Hot-pressed forgings in brass, copper and related alloys; aluminum and magnesium.
(b) To customers' specifications.
(c) Complete facilities.

Rhode Island Tool Co., 148 W. River St., Providence, R. I.
(a) Drop forgings of carbon, alloy and stainless steels, 10 in. dia., 1½ in. thick; 2 in. dia., 18 in. long.
(b) Bolts and nuts and screw machine products.
(c) Heat-treating facilities.

S

St. Pierre Chain Corp., 50 Frank St., Worcester, Mass.
(a) All types of forgings of alloys, soft steels, etc., from 1 oz. to 50 lb.
(b) Automobile, airplane and other machine parts.
(c) Complete facilities.

Scovill Mfg. Co., Waterbury, Conn.
(a) Made-to-order forgings from brass, bronze, copper, and aluminum.
(b) To customers' specifications.
(c) Complete facilities.

Shuler Axle Co. Inc., 2901 S. Second St., Louisville, Ky.
(a) All type forgings in carbon and alloy steel, from 1-300 lb.
(b) Automotive and trailer axles, also heavy-duty two-shoe brakes.
(c) Complete facilities.

Smith-Armstrong Forge Inc., 1209 Marquette Rd., Cleveland.
(a) Hammered forgings in S.A.E. steel specifications; 2-3000 lb. depending upon type of forging; hammer capacity 1100-3500 lb. single frame steam hammers.
(b) Automotive and machine tools.
(c) Machining facilities.

Southern Saw Works Inc., East Point Rd., Atlanta, Ga.
(a) Drop hammer forgings in carbon and alloy steels up to approximately ½ lb. depending on design and shape.
(b) Bits and shanks for inserted tooth saws, wrenches, commercial per specifications.
(c) Heat treating facilities.

Spencer Mfg. Co., Spencer, O.
(a) Rolled and upset forgings.
(b) Axle forgings.
(c) Complete facilities.

Spicer Mfg. Corp., Toledo, O.
(a) Drop, upset and pressure forgings in plain and alloy steels, up to 30 lb.
(b) Universal joint yokes, forks, gears, shafts, etc.
(c) Complete facilities.

Steel, R., & Sons Inc., 4221 Ninth St., Long Island City.
(a) Carbon and alloy steel hammered forgings in 10 in. square or round, and under.
(b) Various.
(c) Machining facilities.

Steel Improvement & Forge Co., 970 E. 64th St., Cleveland.
(a) Drop hammer, upset and press forging.
(b) Machine tool, aircraft, automotive, truck and tractor, marine and coal industries.
(c) Complete facilities.

Storms Drop Forging Co., P. O. Box 2050, Springfield, Mass.
(a) Drop forgings, from fraction of ounce to 50 lb., in all grades of forgeable materials; also hot pressed brass forgings.
(b) To customers' specifications.
(c) Complete heat treating.

T

Taylor Forge & Pipe Works, P. O. Box 485, Chicago.
(a) Drop, upset and hammer forgings of carbon and alloy steels, some nonferrous metals, up to 114 in o.d.
(b) Flanges, rings, nozzles, necks, gear blanks, etc.
(c) Complete facilities.
See advertisement, Page 185

Taylor-Wharton Iron & Steel Co., (Easton, Pa. plant), High Bridge, N. J.
(a) Upset forgings made on 2 in. to 5 in. upsetting machines.
(b) To customers' specifications.
(c) Complete facilities.

Transue & Williams Steel Forging Corp., Alliance, O.
(a) All sizes and types of drop forgings from 1 oz. to 1000 lb. of carbon steels, alloys and nonferrous metals.
(b) Various sizes and types of connecting rods, crankshafts, camshafts, bearing caps, drive-shafts and gears.
(c) Complete heat treating.

U

Union Forging Co., Endicott, N. Y.
(a) Drop and press forgings.
(b) Automotive parts.
(c) Heat-treating facilities.

V

Vulcan Steam Forging Co., 223-257 Rano St., Buffalo, N. Y.
(a) Open die forgings of carbon, alloy, tool and stainless steels, and nonferrous metals.
(b) Gear blanks, crankshafts, piston rods, levers, spindles, rolls, weldless rings, shaped work.
(c) Complete facilities.

W

Wilcox Mfg. Co., The D., N. Chestnut and E. Allen Sts., Mechanicsburg, Pa.
(a) Drop forgings of alloy and carbon steel, 1 oz. to 10 lb.
(b) To customers' specifications.
(c) Information not available.

Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.
(a) Drop forgings in steel and nonferrous metal from ½ oz. to 100 lb.
(b) Structural forged parts, gears, levers, cams, cranks, etc., for machine tools, gas engines, compressors, aircraft, automotive, etc.
(c) Complete facilities.
See advertisement, Page 191

Wyman-Gordon Co., Worcester, Mass., and Harvey, Ill.
(a) Drop hammer, upset and press forgings in steel and aluminum from 10 to 500 lb.
(b) Automotive and aviation.
(c) Heat-treating facilities.

Machine Die Castings Producers

Reference letters beneath addresses of companies refer to: (a) Types, materials and sizes of die castings; (b) Names of die-cast parts customarily produced; and (c) Machining, finishing and assembling facilities.

A

AC Spark Plug Div., General Motors Corp., 1300 N. Dort Highway, Flint, Mich.
(a) Zinc base and aluminum base alloy die castings, from small speedometer parts to castings 26 x 20 inches.
(b) Automotive and aircraft parts.
(c) Complete facilities.

Aluminum Co. of America, 634 Gulf Bldg., Pittsburgh.
(a) Aluminum alloy and zinc die castings, all types and sizes.
(b) To customer's specifications.
(c) Complete finishing facilities.

American Magnesium Corp., 2210 Harvard Ave., Cleveland.
(a) Low and high pressure die castings of various magnesium alloys, in any size.
(b) To customers' specifications.
(c) Light machining.
See advertisement, Page 165

American Meter Co. Inc., Metric Metal Works, Erie, Pa.
(a) Brass, zinc, white metal composed of tin, lead and antimony die castings, from fractions of an inch to 2 x 6 inch castings.
(b) Gas meter parts, etc.
(c) Complete facilities.

Aurora Metal Co., 614 W. Park Ave., Aurora, Ill.
(a) Aluminum bronze and silicon bronze die castings.
(b) Metallic packings for steam locomotives.
(c) Information not available.

B

Badger Die Casting Co., 1570 S. First St., Milwaukee.
(a) Zinc and aluminum alloy die castings, from very small to 10 lb. in zinc and 5 lb. in aluminum.
(b) Aircraft instrument parts, small gasoline engine parts, carburetors, etc.
(c) Complete facilities.

Benton Harbor Malleable Industries, Benton Harbor, Mich.
(a) Special high-grade zinc, virgin aluminum and copper die castings, not to exceed 5 lb.
(b) Machine tool parts, etc.
(c) Machining.

C

Chicago Die Casting Mfg. Co., 2510-14 W. Monroe St., Chicago.
(a) Zinc base alloy die castings in sizes of 14 x 12 x 4 in.
(b) All types of machine parts.
(c) Complete facilities.

Cleveland Hardware & Forging Co., 4518 Lakeside Ave., Cleveland.
(a) Aluminum and zinc from minute to 12½ lb.
(b) Automotive, vacuum cleaners, sewing machines, motors and domestic appliances.
(c) Complete facilities.

Congress Die Casting Div., 3750 E. Outer Drive, Detroit.
(a) Zinc alloy die castings, to 10 lb.; also aluminum.
(b) Pulleys, flexible couplings, vending machine, washing machine, radio, woodworking machine and automotive parts.
(c) Complete facilities.

D

Dayton Die Casting Co., 303 Keowee St., Dayton, O.
(a) Zinc alloy, lead and tin die castings.
(b) To customers' specifications.
(c) Information not available.

Doehler Die Casting Co., Toledo, O., (Other plants at Batavia, N. Y., and Pottstown, Pa.)
(a) Zinc, aluminum, brass, bronze, tin, lead and magnesium die castings.
(b) All types of machine parts.
(c) Machining and finishing facilities.

Dollin Corp., 610 S. 21st St., Irvington, N. J.
(a) All sizes, in aluminum and zinc; high and standard pressure.
(b) All types of machine parts.
(c) Machining and trimming facilities.

Dow Chemical Co., The, Midland, Mich.
(a) Dowmetal, magnesium alloy, die castings.
(b) All types of automotive, aircraft and other machine parts.
(c) None.

F, H, L

Federal-Mogul Corp., 11031 Shoemaker Ave., Detroit.
(a) Tin and lead base, medium and small die castings.
(b) Primarily bearings and bushings.
(c) Complete facilities.

Hoover Co., The, Maple and McKinley Sts., North Canton, O.
(a) Aluminum and zinc die castings, to 24 in. square.
(b) To customers' specifications.
(c) Complete facilities.

Los Angeles Die Casting Co., 340 Crocker St., Los Angeles.
(a) Zinc and aluminum alloys, etc., from 2 to 8 oz. per casting to 13 lb.
(b) Aviation.
(c) Complete facilities.

M

Madison-Kipp Corp., 210 Waubesa St., Madison, Wis.
(a) Zinc and aluminum die castings, all sizes.
(b) Automotive, household appliance, railway, ordnance parts, etc.
(c) Complete facilities.
See advertisement, Page 117

McGill Mfg. Co., Metal Div., Valparaiso, Ind.
(a) Aluminum, bronze and special hard bronze die castings, from ½ oz. to 10 lb. Hydraulic pressure castings of hard yellow brass and silicon bronze, ½ oz. to 2 lb.
(b) Great variety of machine parts including gears, levers, and other corrosion-resistant machine parts.
(c) Complete facilities.

Michigan Die Casting Co., 11831 Charlevoix, Detroit.
(a) Zinc, aluminum and magnesium die castings; to 25 lb. in zinc, 10 lb. aluminum and 2 lb. magnesium.
(b) Automotive and aircraft parts.
(c) Complete facilities.

Milwaukee Die Casting Co., 1015 N. Fourth St., Milwaukee.
(a) Zinc to 5 lb.; aluminum to 4 lb.; lead, tin to 14 lb.
(b) Motor cases, electrical apparatus, ordnance, aircraft, bomb parts, fuses, etc.
(c) Machining and finishing facilities.

Mt. Vernon Die Casting Corp., 118 Pearl St., New York.
(a) Aluminum and zinc; up to 18 lb. in zinc, and 10 lb. in aluminum.
(b) Numerous machine parts.
(c) Machining facilities.

N

National Die Casting Co., 600 North Albany Ave., Chicago.
(a) Aluminum and zinc alloy die castings, from fractions of an ounce to 4 lb.
(b) Oxygen regulators, radio parts, etc.
(c) Complete facilities.

National Lock Co., 1902 Seventh St., Rockford, Ill.
(a) Zinc die castings to 12 in.
(b) To customers' specifications.
(c) Complete facilities.

New Products Corp., 448 North Shore Drive, Benton Harbor, Mich.
(a) Aluminum, brass, magnesium and zinc die castings; up to 5 lb. in aluminum; 1 lb. in brass; 15 lb. in zinc; and 2 lb. in magnesium.
(b) Airplane carburetor parts, rotary pump assemblies, fuse parts, airplane air-speed indicators, etc.
(c) Complete facilities.

P

Paragon Die Casting Co., 5851 W. Dickens Ave., Chicago.
(a) Zinc and aluminum die castings.
(b) Auto, radio, refrigerator, food mixer, washing machine, etc.
(c) Machining and plating facilities.

Parker White Metal & Machine Co., McKinley Ave., at 23rd St., Erie, Pa.
(a) Zinc and aluminum base die castings in any size.
(b) All types of machine parts.
(c) Complete facilities.

Precision Castings Co. Inc., Syracuse, N. Y. (also Cleveland).
(a) Zinc and aluminum die castings, large or small.
(b) To customers' specifications.
(c) Machining and finishing facilities.

Precision Castings Co. Inc., Fayetteville, N. Y. (Branch, Cleveland, O.; Die Shop, Syracuse, N. Y.)
(a) Aluminum and zinc castings from fraction of ounce to 26 lb.
(b) Automotive, household appliances, outboard motors, etc.
(c) Machining, assembling facilities.

Pressure Castings Inc., 21500 St. Clair Ave., Cleveland.
(a) Zinc and aluminum alloy die castings to 24 x 24 in.
(b) To customers' specifications.
(c) Finishing and machining facilities.

S

Schultz Die Casting Co., 1810 Clinton St., Toledo, O.
(a) Zinc base die castings.
(b) Automotive, etc.
(c) Machining and finishing facilities.

Sterling Die Casting Co. Inc., 743—39th St., Brooklyn.
(a) Zinc, aluminum and lead alloy die castings up to 10 lb.
(b) Pump housing and parts, cases, covers, etc.
(c) Finishing facilities.

Superior Die Casting Co., 17325 Euclid Ave., Cleveland.
(a) Zinc and aluminum alloy die castings.
(b) Ordnance, aircraft and various machine parts.
(c) Information not available.

Titan Metal Mfg. Co., Bellefonte, Pa.
(a) Brass and bronze pressure die castings, up to 2 lb.
(b) Electrical, refrigeration, and miscellaneous parts up to 20 lbs.
(c) Machining and assembling.

Toman, E., & Co., 2621 W. 21st place, Chicago.
(a) All types of zinc base die castings from ½ oz. to 8 lb.
(b) To customers' specifications.
(c) Complete facilities.

Union Die Casting Co., 2313-21 East 51st St., Los Angeles.
(a) 80 per cent zinc alloy and 20 per cent aluminum die castings, from ⅛ oz. to 8 lb. each.
(b) Gears, cases and general line of parts.
(c) Complete facilities.

Universal Bearing Co., 639 Broadway, Lorain, O.
(a) Universal bearing metal die castings.
(b) Bearings.
(c) Information not available.

Custom Molders of Plastics

Reference letters beneath addresses of companies refer to: (a) Types of materials utilized; and (b) Names of machine parts customarily molded.

A

Ackerman Plastic Molding, 986 E. 200th St., Cleveland.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, THIOKOL.
(b) Mechanical, electrical and industrial.

Advance Molding Corp., 54 West 21st St., New York.
(a) TENITE I and II, LUCITE, Cellulose Acetate, and other thermoplastics.
(b) All custom molded injection parts.

All American Aircraft Products Inc., 1350 E Anaheim, Long Beach, Calif.
(a) All types of materials.
(b) Aircraft control pulleys, drums, fittings, etc.

American Insulator Corp., New Freedom, Pa.
(a) BAKELITE, DUREZ, PLASKON, BEETLE, LUMARITH, TENITE, PLASTACELE, POLYSTYRENE, LUCITE and cold-molded composition.
(b) To customer's specifications.

American Molding Co., 16th and Vermont Streets, San Francisco.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUMARITH, RESINOX, FIBESTOS, CRYSTALITE, PLASTACELE, LUCITE, POLYSTYRENE, ETHOCEL.
(b) Technical, automotive, electrical, aircraft, etc. Compression, injection, and extrusion molded parts.

American Phenolic Corp., 1830 S. 54th Ave., Cicero P. O., Chicago.
(a) BAKELITE, DUREZ, AMPHENOL, SUNEX, transparent POLYSTYRENE.
(b) Electrical small sections, special rods and tubes, electrical connectors, etc.

American Plastics Corp., 225 W. 34th St., New York.
(a) TENITE, FIBESTOS, LUMARITH, PLASTACELE, LUCITE, etc.
(b) Extruded shapes, ribbons, tubes, rods, etc.

Amos Molded Plastics Div., Amos-Thompson Corp., Edinburg, Ind.
(a) SARAN, ETHOCEL, ACETATE, TENITE II, POLYSTYRENE, LUCITE, CRYSTALITE.
(b) Nozzles, couplings, handles, knobs, push-button lenses, etc.

Armstrong Cork Co., Industrial Div., Lancaster, Pa.
(a) Cork, cork-and-synthetic, synthetic, rubber-like, cork-and-rubber, and fibrated leather.
(b) Gaskets, oil-retaining rings, washers, valve disks, friction wheels, strips, blocks, disks, ribbons, polishing wheels, handles, roll coverings, packings, seals, feed rolls, friction grips, bushings, diaphragms, antiskid parts, glazing strip, vibration-dampening pads, etc.
See advertisement, Page 173

Atlantic Plastics, 2730 Grand Ave., Cleveland.
(a) BAKELITE, BEETLE, PLASKON, DUREZ, RESINOX, TENITE, LUCITE, PLASTACELE, LUMARITH, THIOKOL and other synthetics.
(b) Safety supply parts, lighting and electrical, radio, chemical, mechanical, etc.

Auburn Button Works Inc., Auburn, N. Y.
(a) BAKELITE, DUREZ, RESINOX, BEETLE, PLASKON, TENITE, LUCITE.
(b) All types of machine parts.

B

Berkander Inc., George F., 891 Broad St., Providence, R. I.
(a) TENITE, LUMARITH, PLASTACELE.
(b) To customers' specifications.

Boonton Molding Co., 326 Myrtle Ave., Boonton, N. J.
(a) BAKELITE, DUREZ, RESINOX, TENITE, PLASTACELE, LUCITE, CRYSTALITE, STYRON, POLYSTYRENE, PLASKON, BEETLE.
(b) To customers' specifications.

Butterfield Inc., T. F., 56 Rubber Ave., Naugatuck, Conn.
(a) BAKELITE, DUREZ, MAKALOT, BEETLE, PLASKON, TENITE, LUMARITH, LUCITE, etc.
(b) Radio, heater switch, electrical, etc.

C

Cardinal Corp., 601 W. Eichel, Evansville, Ind.
(a) TENITE, LUMARITH, PLASTACELE, ETHOCEL, LUCITE, CRYSTALITE, POLYSTYRENE and other thermoplastics.
(b) Nameplates and parts made to customer's specifications.

Castle Rubber Co., Butler, Pa.
(a) NEOPRENE, HYCAR and other soft and hard rubber.
(b) Aeroplane, automotive and other molded parts.

Central Die Casting & Mfg. Co. Inc., 2935 W. 47th St., Chicago.
(a) TENITE, LUMARITH, and all other thermoplastics.
(b) All types of molded parts to 8 oz. in weight.

Chamberlain Engineering Ltd., Akron, O.
(a) All molding materials.
(b) To customers' specifications.
Seeadvertisement, Page 112

Chicago Die Mold Mfg. Co., 1735 W. Diversey Parkway, Chicago.
(a) TENITE, BAKELITE, PLASKON, LUCITE, STYRON, etc.
(b) To customers' specifications.

Chicago Molded Products Corp., 1028 N. Kolmar Ave., Chicago.
(a) BAKELITE, DUREZ, RESINOX, PLASKON, BEETLE, TENITE, LUMARITH, SARAN, LUCITE, POLYSTYRENE.
(b) Automotive, industrial, mechanical, scientific, surgical, electrical.
See advertisement, Page 120

Cincinnati Advertising Products Co., Plastics Div., 400 Pike St., Cincinnati.
(a) PLASTACELE, TENITE, LUMARITH, LUCITE, CRYSTALLITE, LUSTRON, POLYSTYRENE and VINYLITE.
(b) All types of injection molded machine parts.

Cincinnati Molding Co., 2037 Florence Ave., Cincinnati.
(a) BAKELITE, RESINOX, DUREZ, PLASKON, BEETLE or any thermosetting plastic.
(b) Electrical, mechanical or decorative parts.

Cleveland Plastics Inc., 1611 E. 21st St., Cleveland.
(a) BAKELITE, BEETLE, CRYSTALITE, DUREZ, ETHOCEL, LUCITE, LUMARITH, MONSANTO, PLASKON, PLASTACELE, RESINOX, STYRON, TENITE.
(b) To customers' specifications.

Columbia Protektosite Co. Inc., Carlstadt, N. J.
(a) All thermoplastic materials such as acetates, butyrates, polystyrenes, vinyls, methyl methacrylates.
(b) Dials, knobs, handles, covers, threaded parts, electrical and radio parts, and specialties.

Compo-Site Inc., 85 Fifth Ave., Paterson, N. J.
(a) Thermoplastic materials.
(b) Knobs, etc.

Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
(a) All plastic materials.
(b) All types of machine parts.

Columbus Plastic Products Inc., 519 Dublin Ave., Columbus, O.
(a) TENITE, LUMARITH, PLASTACELE, POLYSTYRENE, LUCITE, CRYSTALITE and VINYLITE.
(b) All types of injection molded parts to customers' specifications.

Connecticut Plastic Products Co., 124 N. Elm St., Waterbury, Conn.
(a) TENITE, LUMARITH, PLASTACELE, BAKELITE-Acetate, LUCITE, POLYSTYRENE, CRYSTALITE, and other thermoplastic materials.
(b) Business machine parts, camera cases, etc.

Continental Diamond Fibre Co., Newark, Del.
(a) CELORON, DILECTO, DIAMOND FIBRE, VULCOID, DILECTENE, MICABOND, etc.
(b) Gears, couplings, aircraft parts, electrical insulating parts, mechanical and chemical resistant parts.

Cutler-Hammer Inc., 315 N. 12th St., Milwaukee.
(a) THERMOPLAX, PYROPLAX.
(b) Terminal blocks, insulators, switch bases, knobs, handles, insulating bushings, arc shields and miscellaneous electrical insulating forms.

D

Diemolding Corp., Canastota, N. Y.
(a) BAKELITE, DUREZ, PLASKON, BEETLE, TENITE or any other plastics of similar nature.

TRY US ON YOUR *Tough* MOLDING JOBS!

● The products shown here are typical specimens of Imperial custom molding made for such organizations as Allis-Chalmers Mfg. Co., National Enameling & Stamping Co., Johnson Service Co., Teletype Corp., Western Railroad Supply Co., Thermogray Co., Folmer Graflex Corp., and Daniel Woodhead Co.

STOCK KNOBS, PULLS AND HANDLES in a variety of sizes, types and colors. These stock items can often save you time and expense. We try to maintain a large stock assortment on hand.

ASK FOR BULLETIN K-100

★ ★ ★

WE welcome tough jobs! When you have a molding job that involves close tolerances . . . threading . . . deep drawing . . . side cores . . . horizontal bosses . . . metal inserts . . . or where a special technique is required — try IMPERIAL MOLDED.

We are especially equipped to handle jobs of this type and they enable us to demonstrate the full value of Imperial Engineering Service.

You'll find, for example, that threads on Imperial Molded parts are smoother — and harder. This is because threading dies are milled on a special machine, not turned as is customary. This eliminates the little slivers ordinarily left in the die.

If your work requires close fits, we can assure you of unusually accurate control of shrinkage to obtain such fits. This frequently involves expert blending of materials.

We make our own molds and we can still help, in many cases, on jobs related to the war effort.

IMPERIAL MOLDED PRODUCTS CORP., 2855 W. Harrison Street, Chicago, Illinois

IMPERIAL
Plastic Molding

in BAKELITE, PLASKON, DUREZ, MAKALOT, TENITE, BEETLE, LUCITE

(b) Control handles or knobs, small bases and plates, housings, etc.

E

Eclipse Moulded Products Co., Milwaukee.
(a) All plastic materials.
(b) Compression, injection and extrusion molded parts.

Erie Resistor Corp., 644 W. 12th St., Erie, Pa.
(a) All extrusion and injection molding materials.
(b) Aircraft, automobile, radio, refrigerator parts, three dimensional knobs, bezels, etc.; also plastic molded around glass for instrument faces.

Extruded Plastics Inc., New Canaan Ave., Norwalk, Conn.
(a) TENITE II, cellulose acetate butyrate; vinylidene chloride, SARAN, and vinyl resins.
(b) Seamless plastic tubing from ⅛-in. to 1¼-in. outside diameter for oil lines, air lines, etc.

F

Firestone Rubber & Latex Products Co., Fall River, Mass.
(a) All compression and injection molding materials.
(b) Lenses, plastics over metal, refrigerator trim, cabinets and housings, electrical parts, etc.

Franklin Plastics Div., Robinson Industries Inc., Franklin, Pa.
(a) Thermoplastic materials.
(b) Automotive, refrigerator, radio, etc.

G

Garfield Mfg. Co., Garfield, N. J.
(a) BAKELITE, DUREZ, HEMIT, GARIT and TEGIT.
(b) Hot and cold molded parts to customers' specifications.

General Electric Co., Plastics Dept., 1 Plastics Ave., Pittsfield, Mass.
(a) TEXTOLITE (molded, laminated and cold-molded).
(b) All types to customers' requirements.
See advertisement, Page 98

General Industries Co., International Insulating Div., Elyria, O.
(a) BAKELITE, DUREZ, RESINOX, PLASKON, BEETLE, TENITE, LUMARITH, PLASTACELE, LUCITE, CRYSTALITE.
(b) Special parts to customers' specifications.

General Products Corp., Union Springs, N. Y.
(a) BAKELITE, DUREZ, PLASKON and TENITE.
(b) Automotive distributor caps, automotive rotors, collector rings, bushings, boxes and covers, housings, coil tops, condenser tops, etc.

Gits Molding Corp., 4600 W. Huron St., Chicago.
(a) TENITE, LUMARITH, PLASTACELE, LUCITE, POLYSTYRENE.
(b) Radio knobs and cabinets, push-buttons, escutcheons, dials, supports and insulators.

Globe Tool & Molded Products Co., 1032 Mulberry St., Rockford, Ill.
(a) BAKELITE, MAKALOT, DUREZ, RESINOX, BEETLE, PLASKON, TENITE, LUCITE and POLYSTYRENE.
(b) To customers' specifications.

Grigoliet Co., 740 E. North St., Decatur, Ill.
(a) BAKELITE, DUREZ, INDUR, PLASKON and BEETLE.
(b) Molded closures, knobs, handles and custom molded parts.

Gulliksen Mfg. Co., Wm. M., Newton Lower Falls, Mass.
(a) BAKELITE, MAKALOT, PLASKON, BEETLE and DUREZ.
(b) Dies and molds to produce various shapes.

H

Haveg Corp., Newark, Del.
(a) HAVEG.
(b) Acid-resistant equipment, standard tanks, piping, fittings, fume duct, towers, etc.

I

Imperial Molded Products Corp., 2927 W. Harrison St., Chicago.
(a) BAKELITE, RESINOX, DUREZ, MAKALOT, PLASKON and BEETLE.
(b) Handles, knobs, controls, sub-assembly for mechanical working parts such as terminal blocks, insulators, contact blocks, housings, etc.
See advertisement, Page 187

Injection Molding Corp., 115 Fourth Ave., New York.
(a) TENITE, LUCITE, LUMARITH, LUSTRON, STYRENE, PLASTACELE, etc.
(b) To customers' specifications.

Insulation Products Co., 504 North Richland St., Pittsburgh.
(a) BAKELITE, DUREZ, TENITE, PLASKON.
(b) Parts to customers' specifications.

K

Kampa Mfg. Co., 12132 W. Capitol Drive, Milwaukee.
(a) TENITE, STYRON, LUCITE, ETHYL-CELLULOSE, LUMARITH and SARAN.
(b) Switch boxes, insulators and instrument case covers.

Keolyn Plastics Co., 2731 N. Pulaski Rd., Chicago.
(a) TENITE, LUMARITH, PLASTACELE, LUCITE, POLYSTYRENE, VINYLITE and other thermoplastics.
(b) To customers' specifications.

Kilgore Mfg. Co., Plastics Div., Westerville, Ohio
(a) Injection molding of TENITE, LUMARITH, polystyrenes and butyrates.
(b) Parts for autos, radios, etc.

Keystone Specialty Co., 1373½ Cove Ave., Lakewood, O.
(a) Any plastic material to customers' specifications.
(b) Parts to customers' specifications.

Kuhn & Jacob Molding & Tool Co., 1200 Southard St., Trenton, N. J.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUCITE, LUMARITH, etc.
(b) Compression molding of electrical, automotive, radio, airplane, instrument, permanent wave machine parts, etc.; also any type of injection molding.

Kurz-Kasch Inc., 1415 S. Broadway, Dayton, O.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, LUMARITH, TENITE, CRYSTALITE, LUCITE.
(b) Shift balls, general insulating parts, both mechanical and electrical.

M

Mack Molding Co. Inc., Ryerson Ave., Wayne, N. J.
(a) BAKELITE, DUREZ, TENITE, BEETLE, LUMARITH, FIBESTOS, PLASKON.
(b) Parts to customers' specifications.

Martindell Molding Co., N. Olden at Sixth, Trenton, N. J.
(a) Cellulose acetate, phenolics and urea.
(b) To customers' specifications.

Mason Co. Inc., The Thomas, Fairfield Ave., Stamford, Conn.
(a) BAKELITE, TENITE, LUCITE, CRYSTALITE, etc.
(b) Aircraft control pulleys, turret control grip, slip ring assemblies, etc.

McDonald Mfg. Co., 544 E. 31st St., Los Angeles.
(a) BAKELITE, DUREZ, RESINOX, PLASKON and BEETLE.
(b) Aircraft and miscellaneous electrical parts, radio cabinets, knobs, etc.

Metal Specialty Co., 814 South L St., Richmond, Ind.
(a) ETHOCEL, TENITE, CRYSTALITE, LUCITE, POLYSTYRENE, LUMARITH, NIXONITE, etc.
(b) Automobile, radio and refrigerator parts.

Michigan Molded Plastics Inc., G and Baker Sts., Dexter, Mich.
(a) BAKELITE, DUREZ, TENITE, PLASTACELE, LUMARITH, PLASKON, LUCITE, SARAN and MONSANTO.
(b) Molded plastic parts, all types and sizes by compression, injection and extrusion.

Midwest Molding & Mfg. Co., 337 N. Whipple St., Chicago.
(a) BAKELITE, DUREZ, RESINOX, BEETLE and PLASKON.
(b) Terminal blocks, electrical parts, etc.

Mills Corp., Elmer E., 812 W. Van Buren St., Chicago.
(a) VINYLITE, TENITE, LUMARITH, PLASTACELE, FIBESTOS, LUCITE, CRYSTALLITE, POLYSTYRENE, STYRON, LUSTRON and LOALIN.
(b) Fittings, tubing and other parts.

Molded Insulation Co., 335 E. Price St., Philadelphia.
(a) BAKELITE and other plastics.
(b) Aircraft, radio, electrical and other machine parts and assemblies.

Molded Products Co., 4533 W. Harrison St., Chicago.
(a) BAKELITE, DUREZ, RESINOX, MAKALOT, INDUR, PLASKON, BEETLE and MELMAC.
(b) To customers' specifications.

Molding Corp. of America Inc., 40 Church St., Pawtucket, R. I.
(a) All types of plastics.
(b) To customers' specifications.

N

Niagara Insul Bake Specialty Co. Inc., 483 Delaware Ave., Albany, N. Y.
(a) BAKELITE, DUREZ, RESINOX, MAKALOT, PLASKON, BEETLE, LUCITE, TENITE, LUMARITH, and CRYSTALITE.
(b) Air dash pots, etc.

Northern Industrial Chemical Co., 7 Elkins St., South Boston, Mass.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUMARITH, etc.
(b) Any molded part to customers' specifications.

Northwest Plastics Inc., 2233 University Ave., St. Paul, Minn.
(a) BAKELITE, INDUR, DUREZ, MAKALOT, LUCITE, RESINOX, BEETLE, and PLASKON.
(b) Industrial parts of all types.

Norton Laboratories Inc., 520 Mill St., Lockport, N. Y.
(a) BAKELITE, DUREZ, PLASKON, BEETLE, TENITE, LUMARITH, LUCITE, CRYSTALITE, PLASTACELE.
(b) Housings, terminals, bushings, wheels, knobs, handles, etc.

O

Oris Mfg. Co. Inc., 1 Jackson St., Thomaston, Conn.
(a) BAKELITE, DUREZ, RESINOX, BEETLE and PLASKON.
(b) Handwheels, bushings, etc.

P

Peerless Molded Plastics Inc., 401 Hamilton St., Toledo, O.
(a) DUREZ, RESINOX, BAKELITE, TENITE, LUMARITH, LUCITE, and PLEXIGLAS.
(b) Electrical, mechanical, radio, automotive, camera, etc.

Pierce Plastics Inc., 116 First St., Bay City, Mich.
(a) TENITE, SARAN, LUSTRON, VINYLITE, LUMARITH, PLASTACELE, ETHOCEL, CRYSTALITE, LUCITE, and KOROSEAL.
(b) Electrical, trim, etc.

Plastics Inc., 813 Main St., Avon, N. J.
(a) BAKELITE, TENITE, LUCITE, LUMARITH and PLASTACELE.
(b) Parts for refrigerators, vacuum cleaner housings, automotive panel parts, horn button assemblies, radio and electrical parts, housings, etc.

Potter & Brumfield Mfg. Co. Inc., Princeton, Ind.
(a) DUREZ, RESINOX and BAKELITE.
(b) Cams, terminal boards, and relay parts.

Pyro Plastics Co., The, 526-532 North Ave. East, Westfield, N. J.
(a) TENITE, PLASTACELE, LUMARITH, FIBESTOS, POLYSTYRENE, LUCITE, CRYSTALITE.
(b) To customers' specifications.

R

Rathbun Molding Corp., 290 Rochester St., Salamanca, N. Y.
(a) PLASKON, BEETLE, BAKELITE and DUREZ.
(b) Electrical parts, knobs and handles.

Remler Co. Ltd., 2101 Bryant Ave., San Francisco.
(a) BAKELITE, DUREZ, PLASKON, TENITE, etc.
(b) Electric terminals and switch parts, housings, handles, levers, operating keys and buttons, gears, etc.

Reynolds, Molded Plastics Div., Reynolds Spring Co., Cambridge, O.
(a) BAKELITE, PLASKON, TENITE, LUMARITH, BEETLE, DUREZ, LUCITE.
(b) All types to customers' specifications .

Richardson Co., The, 27th and Lake Sts., Melrose Park, Ill.
(a) INSUROK, EBROK, RUB-TEX, RUBEROK and MICAROK.
(b) All types to customers' specifications.
See advertisement, Page 91

Rogan Brothers, 2001 S. Michigan Ave., Chicago.
(a) BAKELITE, DUREZ, PLASKON and BEETLE.
(b) Sockets, bases, knobs, etc.

Royal Moulding Co., 69 Gordon Ave., Providence, R. I.
(a) BAKELITE, RESINOX, DUREZ, PLASKON, BEETLE, MAKALOT.
(b) Electrical appliance housings.

S

Shaw Insulator Co., 150 Coit St., Irvington, N. J.
(a) All plastic materials.
(b) All types of parts.

Sheller Mfg. Corp., Portland, Ind.
(a) SHELLERITE, acetates and butyrates.
(b) Compression and injection molded parts up to 22 oz. such as steering wheels, caps, cabinets, etc.

Southern Plastics Co., 906-908 Main St., Columbia, S. C.
(a) TENITE I and II, BAKELITE, LUMARITH, PLASTACELE and practically all thermoplastics and thermosetting plastics.
(b) Cotton loom sheaves, tubing, bearings, nameplates, strips, links, etc.

Specialty Insulation Mfg. Co. Inc., Hoosick Falls, N. Y.
(a) COLASTA, BAKELITE, DUREZ, TENITE, BEETLE, PLASKON, etc.
(b) Business machines parts, etc.

Sterling Injection Molding Inc., 277 Military Rd., Buffalo.
(a) LUMARITH, FIBESTOS, TENITE I and II, ETHOCEL, PLASTACELE, VINYLITE, SARAN, LUCITE, PLEXIGLAS, POLYSTYRENE and other thermoplastics.
(b) Handles, rollers and other injection molded machine parts.

Sterling Plastics Co., 1140 Commerce Ave., Union, N. J.
(a) LUCITE, TENITE, LUMARITH, POLYSTYRENE, and CRYSTALITE.
(b) Knobs, cigarette vending machine parts, nameplates, dehydrator tubes and dials for aircraft, compasses, etc.

Stokes Rubber Co., Jos., Taylor and Webster Sts., Trenton, N. J. (Plant also at Welland, Ont., Canada)
(a) All types of thermosetting and thermoplastic materials.
(b) Parts made by compression or injection molding.

Stricker-Brunhaber Corp., 19 W. 24th St., New York.
(a) BAKELITE, CATALIN, TENITE and transparent plastics.
(b) Injection and compression moldings.

T

Tech-Art Plastics Co., 41-01 36th Ave., Long Island City, N. Y.
(a) All plastic materials.
(b) Compression and injection molded parts for electrical equipment and instruments.

Terkelsen Machine Co., 326 A St., Boston.
(a) DUREZ, INDUR, MAKALOT, BAKELITE, PLASKON and BEETLE.
(b) To customers' specifications.

Ther Electric & Machine Works, 17 S. Jefferson St., Chicago.
(a) DUREZ, BAKELITE, PLASKON, etc.
(b) To customers' specifications.

U

United States Stoneware Co., Akron, O.
(a) Compression molding and extruding of TYGON synthetic resins.
(b) To customers' specifications.
See advertisement, Page 113

Universal Plastics Corp., 235 Jersey Ave., New Brunswick, N. J.
(a) All materials which can be compression and injection molded.
(b) To customers' specification.

V

Victor Metal Products Corp., 196 Diamond St., Brooklyn.
(a) BAKELITE, PLASKON, RESINOX, POLYSTYRENE and TENITE.
(b) Parts requiring high impact material, such as rollers, wheels, etc.

W

Ward Plastic & Rubber Co., 900 Woodward Ave., Rochester, Mich.
(a) All thermoplastic and thermosetting materials.
(b) To customers' specifications.

Warren Plastics Corp., Warren, Pa.
(a) BAKELITE, DUREZ, RESINOX, BEETLE, PLASKON, MASURON.
(b) Small machine parts.

Waterbury Button Co., The, 39 River St., Waterbury, Conn.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUCITE, SHELLAC COMPOSITION, LUMARITH, RESINOX, CRYSTALITE, POLYSTYRENE, etc.
(b) All types to customers' specifications.

Watertown Mfg. Co., 138 Echo Lake Rd., Watertown, Conn.
(a) NEILLITE, BAKELITE, DUREZ, RESINOX, TENITE, LUMARITH, FIBESTOS, PLASTACELE, LUCITE, BEETLE, PLASKON.
(b) Contact blocks, insulator blocks, switch housings, cams, spacers radio cabinets, cases and any other moldable parts.

Werner Co. Inc., R. D., 389 Second Ave., New York.
(a) TENITE, LUMARITH and all other thermoplastic materials.
(b) Trim, hose, gaskets, handles, etc.

White Dental Mfg. Co., The S. S., Plastics Dept., 10 E. 40th St., New York.
(a) TENITE, LUMARITH, LUCITE, CRYSTALITE, POLYSTYRENE.
(b) Automotive, aircraft, electrical, etc.

Winborne Plastic Moulding Corp., 3835 Ninth Ave., New York.
(a) Sheet plastics, methyl methacrylates, cellulose acetates, vinyls, acetate butyrates and polystyrenes.
(b) Aircraft enclosures, bomber noses, etc.

Windman Brothers, 3325 Union Pacific Ave., Los Angeles.
(a) BAKELITE, DUREZ, PLASKON, BEETLE, all phenolics and ureas; Styrenes, acrylic resins and TENITE or cellulose acetates.
(b) Electric razor cases, radio cabinets, electrical, mechanical, dental, photographic and surgical equipment parts.

Machine Finishes Producers

Reference letters beneath addresses of companies refer to: (a) Trade-name and type of finish, availability in color; (b) Method of application and drying; and (c) Characteristics and use of finish.

A

Alrose Chemical Co., P. O. Box 1294, Providence, R. I.
(a) JETAL, for obtaining black finish on ferrous metals.
(b) Chemical oxidation by immersion.
(c) Decorative, rustproofing, heat resisting; for machines, appliances.

Aluminum Co. of America, Gulf Bldg., Pittsburgh.
(a) ALROK (aluminum oxide) colorless, bluish or greenish grey, dyed colors. ALUMILITE (aluminum oxide) colorless, dyed colors.
(b) Alrok—chemical; Alumilite—electrolytic.
(c) Alrok, corrosion and abrasion resistant; applied to aluminum parts for protection or as surface preparation for painting. Alumilite, better resistance to corrosion and abrasion; used for protection and decorative applications.

Aluminum Industries Inc., 2438 Beekman St., Cincinnati.
(a) PERMITE lacquer enamel or enamel, in all shades of gray.
(b) For brushing and spraying, or drying by air.
(c) Rustproofing and protection of all types of machine parts.

American Products Mfg. Co., Oleander & Dublin Sts., New Orleans, La.
(a) INCELOID cellulose and resin bases, in all colors and irridescent.
(g) May be applied by any method; atmosphere and oven dried.
(c) Decorative; on all standard types of machines.

Apollo Metal Works, 6605 S. Oak Park Ave., Chicago.
(a) APOLLO pre-chromed metal, in bright and satin chrome and satin striped patterns.
(b) Plating.
(c) For conserving brass, copper, aluminum, nickel where corrosion resistance or reflectivity is desired.

Arco Co., The, 7301 Bessemer Ave., Cleveland.
(a) ARCO lacquers, synthetics and oil enamels; available in standard machine tool gray or special shades. INFRAY paint in standard colors of the U. S. Army Engineers Corps.
(b) Adaptable for any application method; air or force dried.
(c) Arco is rust, heat and oil resistant, for all industrial machinery, and INFRAY is infra-red-reflecting, heat-reflecting and low visibility paint, developed primarily to meet war needs.

Ault & Wiborg Corp., 75 Varick St., New York.
(a) POLYMERIN speedbake enamel, WRINKLE enamel, and AULTONE lacquers; available in all colors.
(b) POLYMERIN and WRINKLE for spraying and dipping, and baking (all methods including infra-red); AULTONE applied by knife or sprayed, and air dried.
(c) Decorative, protective, heat and cold resistant; for any part suitable for baking.

B

Berry Brothers, Detroit, Mich.
(a) BERRY No. 10 synthetic gray primer, No. 97 blue gray synthetic machinery enamel (semigloss), No. 5 red pyroxylin primer, No. 26 blue gray synthetic machinery lacquer, No. 625 red oxide primer, and No. 16BQ.D. blue gray machinery enamel (semi-gloss).
(b) No. 625 may be sprayed or brushed, while 16B is recommended for spraying; all finishes dry quickly; No. 625 dries overnight and No. 16B is dust free in 30 minutes and dries in 3-4 hours.
(c) No. 10 is used for exterior of castings and sheet steel, and all are used for general machinery purposes.

Bownes, Frank, Co., Chelsea, Mass.
(a) MODENE, mill whites and synthetic enamels and special finishes.
(b) For spray, brush and dip; air dried and baked.
(c) Decorative and protective; for machine tools.

C

Central Paint & Varnish Works, 63-69 Prospect St., Brooklyn.
(a) CENTRAL synthetic porcelainized machinery and engine finish; available in colors.
(b) For brush, spray or dip; air dry.
(c) Decorative, rustproofing and cleanliness; for all types of machinery exposed to scrutiny of public.

Chemical Research Corp., 214 E. 19th St., Tulsa, Okla.
(a) RESISTAL HCL-340-A, -400, G-100, M-600; water-clear coatings, for metals and alloys.
(b) All can be brushed, sprayed or dipped, while G-100 type can be applied by roller coating methods; dry dust-free in 10 minutes.
(c) G-100 has excellent adhesion to all wood and metal surfaces; HCL-340-A to all metal aircraft exteriors without use of primer; all are tough, nonporous, durable, and have high dielectric strength.

Chromium Corp. of America, 120 Broadway, New York. (Plants also in Waterbury, Conn., Cleveland and Chicago.)
(a) CRODON chromium plating (also copper, nickel, etc.); in metallic colors only except for special processes.
(b) Electroplating.
(c) Decorative, rustproofing, hardness; for various types of machines.

Cleaveland Laboratories & Mfg. Co. Inc., Holland Ave., Peapack, N. J.
(a) NO-TARNISH lacquer and NO-TARNISH copper, brass and silver finish; clear and colorless.
(b) Brushed, sprayed or dipped; air dried.
(c) For tarnish and rustproofing of all metals subject to corrosive action of elements, particularly copper, brass, silver, nickel.

Creutz Platers Inc., S E—Third and Vine, Cincinnati.
(a) Silver, gold, polished chrome, hard chrome, copper, nickel, cadmium; anodizing, lacquering; in all colors.
(b) Plating, spraying, aluminizing; oven and air drying.
(c) Decorative and for rustproofing.

D

Day, James B., & Co., 1872 Clybourn Ave., Chicago.
(a) NITROLITE lacquer enamel; and a synthetic baking enamel.
(b) Lacquer sprayed or dipped and air dried; enamel sprayed and baked.
(c) Decorative; for any type of metal machine part.

Densol Paint Co., 9808 Meech Ave., Cleveland.
(a) DENSOTECH and DENSOL machine tool finishes. Former available in clear liquid, latter in NTBA gray, light gray, maroon, red, olive green and white.
(b) For brushing, spraying or dipping.
(c) Former for rustproofing and to preserve bright-plated finish on metal parts; DENSOL for use on all types of machine tools.

Detroit Macoid Corp., 12340 Cloverdale, Detroit.
(a) CELLUCRAFT plastic coating, in all colors; MACOID in all colors.
(b) CELLUCRAFT for spraying; MACOID for dipping; air dried.
(c) CELLUCRAFT for protective purposes; MACOID for decorative as well as protective.

Dibble Color Co., 1497 East Grand Blvd., Detroit.
(a) DIBBLE standard machinery finishes in gray, black, white and red.
(b) For brushing and spraying; air drying and baking.
(c) Rustproofing; for milling and broaching machines, lathes, presses, etc.

Di-Noc Mfg. Co., 1700 London Rd., Cleveland.
(a) DI-NOC film involving special process to reproduce wood grains and other effects.
(b) May be applied to steel, wood and composition material, or furnished in form of prefinished sheets.
(c) Heat, cold and salt spray resistant; for radios, automobiles, airplanes, air conditioning units, business machines and similar equipment.

E

Egyptian Lacquer Mfg. Co., 1270 Sixth Ave., New York.
(a) EGYPTIAN lacquers and synthetics, in any standard line of colors; also to match.
(b) For spraying, dipping or brushing; air drying and baking.
(c) For protection and decoration, on all types of metal, and machine tools.

See advertisement, Page 184

Enterprise Galvanizing Co., Cumberland & Almond Sts., Philadelphia.
(a) Hot dip galvanizing zinc silver-colored finish.
(b) For dipping.
(c) For use where corrosion resistance is required; in laundry machines, refrigeration, ice, textile and electrical machines, etc.

F

Felton Sibley Co., Inc., 136 N. 4th St., Philadelphia.
(a) Machinery paint and enamel; available in color.
(b) For brush and spray; air dry.
(c) Decorative, rustproofing, heat resistant; for machine tools, canning machines, turbines, etc.

Ferro Enamel Corp., 4150 East 56th St., Cleveland.
(a) FEROC inorganic porcelain finishes; in all colors and shades.
(b) For spray; dip; fire at approx. 1500 degrees Fahr.
(c) Decorative, rustproofing, cleanliness; for food, chemical processing, textile machinery, etc.

Forbes Varnish Co., 3800 W. 143d St., Cleveland.
(a) NITROLOID light primer HV-8175 and NITROLOID 7B NMTB machinery gray HV-4209 lacquer.
(b) Sprayed; air dried.
(c) General protection, oil resistant; for all light and heavy machinery.

Frazer Paint Co., 2475 Hubbard, Detroit.
(a) FRATEX synthetic enamel and TUFTEX machinery enamel; former in 20 standard enamels or special colors to match; latter in 10 standard shades or special to match color.

(b) For spray or brush; air dry.
(c) For decoration and protection for all metal machinery.

Frey-Yenkin Paint Co., 251 N. Sandusky St., Columbus, O.
(a) MAJESTIC paint, varnish and enamel in various colors.
(b) For brush, spray, flow, or dip; air or bake dried.
(c) For decoration, rustproofing, etc., of all types of machines.

G

Gill Co., Frank, 160 Second St., North, Wisconsin Rapids, Wis.
(a) GILLS industrial paint, lacquer, enamel and varnish; in any available color.
(b) For spray, brush and dip; air or bake dried.
(c) Decorative, rustproofing purposes, etc., on all types of machines.

Great Lakes Varnish Works Inc., 2207-35 N. Crawford Ave., Chicago.
(a) MONOCOTE olive drab primer and lusterless enamel.
(b) Can be applied in any way; baked or air dried.
(c) Rustproofing, protective, and camouflage purposes, for tanks, machines, etc.

H

Hague, Alfred, & Co. Inc., 227—34th St., Brooklyn.
(a) RUBALT No. 269 enamel; available in custom colors.
(b) Can be applied by any method; air dried or low baked.
(c) Rustproofing; for any type of machinery.

Haynes Laboratories Inc., C. W., Chandler St., Springfield, Mass.
(c) Lacquers and synthetics in any color.
(b) Brush and spray; air dry.
(c) For coating any type of machine.

Hilo Varnish Corp., 42 Stewart Ave., Brooklyn.
(a) HILO paints, lacquers, enamel synthetics in all colors; varnish, etc., also black japans, and protective coatings to meet government specifications.
(b) Can be applied by any method.
(c) Paints are used for rustproofing and protecting all types of machines, equipment, etc.

Hommel, O., Co., 209 Fourth Ave., Pittsburgh.
(a) HOMMELAYA process of vitreous enameling in any color or shade.
(b) For spray or dip; drier equipment.
(c) Decorative, rustproof or heat resistant; for any type of machine.

Hooker Glass & Paint Mfg. Co., 651 Washington Blvd., Chicago.
(a) KING machine and engine enamel available in color; No. 6132 standard machine tool gray enamel.
(b) For brush or spray; air dry.
(c) Decorative, protective; King enamel for gas engines, steam engines, presses, machine tools, dynamos, etc.; No. 6132 for woodworking and metalworking machinery.

Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia.
(a) HOUGHTO-BLACK finish for blackening steel parts.
(b) Applied by immersion in salt bath.
(c) Used where corrosion resistance is required.

I

Indium Corp. of America, 805 Watson Place, Utica, N. Y.
(a) INDIFUSED Indium, silver luster finish.
(b) Plating and diffusion.
(c) Wear and corrosion resistant, decorative and functional finish for nonferrous metals, etc.

See advertisement, Page 197

Irvin, Jewell & Vinson Co., 17 E. Third St., Dayton, O.
(a) ANCO plastic paste form paint in special colors and white.
(b) For spraying, rubbing in, etc.; air dried, infrared light dried, low heat.
(c) For use in indentations such as auto dials, electric refrigerators, etc.

K

Krome-Alume Inc., 241 Bewley Bldg., Lockport, N. Y.
(a) KROME-ALUME plated aluminum finish.
(b) Plating.
(c) For plating aluminum with nickel and chromium for decorative purposes; with nickel and chromium for wear resistance in machine parts; with brass for rubber adhesion; with copper for soldering by ordinary means and with such corrosion-resistant metals as cadmium, zinc, etc.

L

Lasting Products Co., 200-212 S. Franklintown Rd., Baltimore.
(a) PAINT MASTER'S wrinkle finish in any color.
(b) For spraying, brushing, dipping or roller coating; baking oven dried or under infrared lights.
(c) Tough and durable, for fans, pumps, castings, cameras, radios, motors, etc.

Liquid Plastic Div. of Ferro Enamel Corp., 4150 East 56th St., Cleveland.
(a) VEDOC synthetic finish; available in black and white, or color on request.
(b) For spraying and dipping; baked.
(c) Decorative and protective; for washing machines, refrigerators, etc.

Long Jr. Co., Charles R., 1630-1644 W. Hill St., Louisville, Ky.
(a) STABRITE machine enamel in any color but not white.
(b) For brush, spray, flow or dip; air dry or bake.
(c) Protective and decorative; for motors, generators, transformers and other machines.

M

Master Mechanics Co., 2097 Columbus Rd., Cleveland.
(a) EISEN-HEISS chemical enamel, in colors.
(b) For brushing or spraying; air drying.
(c) Rustproofing, heat, acid and alkali resistance; for machine tools.

Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.
(a) METALUSTRE lacquer enamels and synthetic enamels available in 28 standard colors; RAYDUR synthetic enamels in most colors; DUART WRINKLE enamels in most colors; CODUR enamels in colors; and DYKAST lacquer enamels in most colors.
(b) Metalustre, spray, air dry and bake; Raydur, spray or dip, bake (Infra-red) ovens; Duart, spray; Codur, spray or dip; and Dykast, spray and dip, air dry.
(c) Decorative and protective coatings; Metalustre is used for sheet metal work and castings; Raydur on any machine requiring a tough, durable finish; Duart for cabinets and metal or Bakelite parts that can be baked; Codur for any type of machine requiring moisture and chemical resistant finish; and Dykast for zinc and aluminum die castings.

McDougall-Butler Co. Inc., Buffalo, N. Y.
(a) HARDCOTE synthetic finishes in over 30 color combinations; also varnishes, enamels, and paints.
(b) Brush, spray or dropper method; and dries dust-free in 15 minutes and hard in one hour.
(c) For inside or outside surfaces of wood, metal or plastics; corrosion resistant.

Merkin Paint Co. Inc., M. J., 1441 Broadway, New York.
(a) MERKIN industrial enamel in various colors.
(b) For brushing or spraying; air dried.
(c) For protective and decorative purposes on any machine where durability and "light-for-seeing" are factors.

Mitchell-Bradford Chemical Co., 2446 Main St., Bridgeport, Conn.
(a) BLACK-MAGIC, DIE-CAST BLACK and WITCH DIP, blackening salt for steel, iron, copper and zinc.
(b) For dipping; self-drying.
(c) Decoration and rustproofing; for fabricated steel and wire parts, screw machine parts, small arms, etc.

Mitchell-Mayer Co., 3506 Market St., St. Louis.
(a) SUNBRITE silver, bronze, and aluminum powders; in all shades.
(b) For spraying, dipping and brushing.
(c) Decorative, heat resistive, etc.; for all types of machines.

Monsanto Chemical Co., Merrimac Div., Everett Sta., Boston.
(a) MERTEC and R-4000; both lacquers available in color.
(b) Both applied by spray or brush; air dried.
(c) Corrosion resistant; for chemical plant machinery, laundry and mill machinery, etc.

N

New Jersey Lacquer Co. Inc., 4400 Dell Ave., North Bergen, N. J.
(a) PYROLAC lacquers, synthetic coatings; available in all colors.
(b) For spray, dip, brush; air dry and bake.
(c) Decorative, heat resistant, rustproofing; for cinema projectors, cameras, typewriters, scales, electric instruments, etc.

New Wrinkle Inc., Dayton, O.
(a) WRINKLE enamel in all colors.
(b) Applied by spraying; oven or Infra-red dried.
(c) Decorative and protective; for all types of machines.

See advertisement, Page 115

Nikolas & Co., G. J., 1227-1235 Van Buren St., Chicago. (also 33 Grand St., Brooklyn, N. Y.)
(a) NIK-O-LAC lacquer in all colors.
(b) For brushing, spraying and dipping; air drying.
(c) For decorative and heat-resistant purposes for all types of machines.

O

O'Brien Varnish Co., 101 N. Johnson St., South Bend, Ind.
(a) O'BRIEN machinery enamels, in gray, eggshell gray, light gray, yellow, red, and dark green.
(b) For brushing or spraying; air drying.
(c) Decorative, heat resistant; for all types of machinery.

O'Neil Duro Co., 2156 S. Fourth St., Milwaukee.
(a) DURO lacquer and enamel in gray or any color.
(b) For brush, spray or dip; for baking, air drying or infrared radiation.
(c) Decorative, rustproofing, heat resisting, etc.

Ohio Bronze Powder Co., 1120 E. 152nd St., Cleveland.
(a) LUXRITE bronze powders, in silver, gold, copper and other shades.
(b) Plating, spraying or dipping; air drying.
(c) Rustproofing, heat resisting and decorating; on agricultural and other types of machinery.

P

Parker Rust-Proof Co., 2177 East Milwaukee Ave., Detroit.
(a) PARKERIZING, BONDERIZING and PARCO LUBRIZING.
(b) Spray or dip; force drying.
(c) Rustproofing and as a base for paint, lacquer, enamel and oil finishes; also PARCO LUBRIZING for bearing surfaces to prevent scuffing.

Pecora Paint Co. Inc., 3501 N. Fourth St., Philadelphia.
(a) PECORA DRESDEN machine enamel, in red, maroon, dark green, Peco green, light gray, tool gray, light and medium steel.
(b) For spraying and dipping.
(c) For all types of machinery, including laundry units.

Peninsular Paint & Varnish Co., 8250 St. Aubin Ave., Detroit.
(a) KLEEN-EZY and PENPROX, paint, varnish, enamel and lacquer; in all colors.
(b) For brush, spray or dip; air drying or baking.
(c) Decorative, rustproofing, heat resisting, etc.; for all types of machinery.

Phelan-Faust Paint Mfg. Co., 932 Laughborough Ave., St. Louis.
(a) PHELUXE synthetic finish available in red, blue, green, yellow, orange, white, black, and cream.
(b) For dipping, brushing or spraying; air or bake dried.
(c) For protective and decorative purposes, on all types of machines.

Pittsburgh Plate Glass Co., Industrial Paint Div., Grant Bldg., Pittsburgh.
(a) Pittsburgh industrial finishes; paints, varnishes, lacquers and special process finishes to manufacturers specifications.
(b) Suitable for all methods of application.
(c) Decorative and protective finishes for all types of machines.

Porcelain Enamel & Mfg. Co., Eastern & Pemco Ave., Baltimore.
(a) PEMCO porcelain enamels. Glazes in any color.
(b) For spray and dip; continuous dryer.
(c) Decorative and rustproofing; for all types of machines.

Porcelain Metals Inc., 28-20 Borden Ave., Long Island City, N. Y.
(a) SUPORCEL porcelain enamel, all colors and textures.
(b) For spraying; hot air, then firing at 1550 degrees Fahr.
(c) Decorative, where sanitation, permanency of finish and easy cleaning is required.

Pyrene Mfg. Co., 560 Belmont Ave., Newark, N. J.
(a) UDYLITE, cadmium finish, in silvery-white; BRIGHT ZINC in silvery white; PYRENE BRIGHT NICKEL, thick deposits of high brilliance; BONDERITE, in grey paint base; CHROMIUM; ALUMILITE; PARKERIZING, silvery to variety of black finishes. ANODIZING by Alumilite process for protection and finishing of aluminum and its alloys.
(b) Udylite, Bright Zinc, Bright Nickel and Chromium plating; Bonderite, Parkerizing immersion; Alumilite, electrolytic; Parkerizing chemical displacement without changing dimensions or physical characteristics.
(c) Rustproofing, decoration, as base for plating, or for wear resistance.

Q

Quigley Co. Inc., 56 W. 45th St., New York.
(a) TRIPLE-A industrial enamels in maroon, green, red, orange, gray, blue, buff, yellow, black, white, and aluminum.
(b) For brushing and spraying; dries by evaporation.
(c) Protective, waterproofing coating used on wide range of machinery and equipment.

R

Reilly Tar & Chemical Corp., 1615 Merchants Bank Bldg., Indianapolis.
(a) RESISCOTE paint, in gray, etc.
(b) Brush or spray; air dried or baked.
(c) Rustproofing, protection against corrosive gases, etc.; for all types of machines.

Roxalin Flexible Lacquer Co., 806 Magnolia Ave., Elizabeth, N. J.
(a) ROXAPRENE synthetic enamel, in all colors; RINCONTROL wrinkle enamel, in practically all colors.
(b) For spraying and dipping; Rincontrol only for spraying.
(c) Both are decorative and corrosion resistant; Roxaprene used for air conditioning equipment, etc.; Rincontrol used for business and electrical appliances.

Ruberoid Co., 500 Fifth Ave., New York.
(a) RUBEROID rapid asphalt paint, in black only.
(b) For spraying and dipping.
(c) Rustproofing, resistance to high temperature, acid fumes, etc.; for cables, tubing, tanks, battery boxes, etc.

S

Seaporcel Corp., 28-20 Borden Ave., Long Island City, N. Y.
(a) SEAPORCEL matte finish porcelain enamel.
(b) For spraying; hot air, then firing at 1550 degrees Fahr.
(c) Decorative, where sanitation, permanence of finish and easy cleaning are required. Made especially for use on ships, and where weight is a factor.

Seidlitz Paint & Varnish Co., 18th and Garfield Ave., Kansas City, Mo.
(a) SEIDLITZ synthetic enamels and primers, in snow white, black and all colors.
(b) For brushing, spraying or dipping; air dry or bake.
(c) Decorative and protective; for all kinds of machinery.

Sherwin-Williams Co., 101 Prospect Ave., Cleveland.
(a) KEM ENAMELS; also paints, varnishes and lacquers to suit individual requirements, and heat resistant finishes.
(b) Brush or spray; air drying or baking.
(c) For application to all types of machines. KEM ENAMELS save finishing time; 4 or 5 coats can be applied in 6¼ to 9 hrs.

Simoniz Co., 2100 Indiana Ave., Chicago.
(a) COROL semi-hard removable anticorrosive.
(b) For spray, dip, brush; air dried, nonoxidizing.
(c) For rust and corrosion prevention of all types of machines.

Smith-Davis Paint Co., 10751 Venice Blvd., Los Angeles.
(a) CON-SEAL synthetic enamel and lacquer, in 27 colors, black, white and clear.
(b) For brushing and spraying; air drying.
(c) For decoration and rustproofing; on transformers, industrial machinery, pumps, automobiles and trucks.

Sonneborn Sons Inc., L., 88 Lexington Ave., New York.
(a) SONNEBORN'S machine and engine enamel in 14 colors, No. 3738 heat resisting gray enamel in light gray, and S.R.P. No. 75 red primer in reddish brown.
(b) Brush or spray; dry by air overnight.
(c) Machine and engine enamel is for decoration, oil-proofness, durability and withstanding heat up to about 200 degrees Fahr. No. 3738, also for decoration, and capable of withstanding heat up to about 350 degrees Fahr. Type S.R.P. No. 75 is used for rustproofing on various types of machines.

Special Chemicals Corp., 30 Irving Place, New York.
(a) SPEKWITE copper, zinc and tin finish in white; SPEKYELLO copper, zinc, tin finish in yellow bronze.
(b) Electroplating.
(c) Rustproofing and heat resistant finish; for all types of machines.

Standard Enameling Co., 8536 Hays St., Culver City, Calif.
(a) Porcelain enamel available in all colors.
(b) For spraying or dipping.
(c) For rustproofing, heat and abrasion resistance, decorative purposes, etc., for food and chemical machines.

Stewart Bros. Paint Co., Alliance, O.
(a) Engine enamel in grey.
(b) Spraying.
(c) For decorating and preserving engines and machinery.

Stonhard Co., 401 N. Broad St., Philadelphia.
(a) STONHARD RUSTPROOFER; colorless. STONHARD steel protection coat in heavy black.
(b) Spraying and painting.
(c) To prevent deterioration of all metal surfaces.

Superior Metal Works, 66th Place at S. Oak Park, Chicago.
(a) SUPERIOR chrome, nickel, brass and copper plating in bright and satin-plated finishes, striped or crimped to a variety of patterns.
(b) Plating.
(c) For substituting for solid nickel, iron, copper, aluminum, stainless, on sheets to conserve critical metal.

T

Thompson & Co., 1085 Allegheny Ave., Oakmont, Pa.
(a) RABAKE enamel (infrared bake), in white, gray and green; also GRAY METALLIC dull aluminum finish.
(b) Spraying; baking short period.
(c) RABAKE for heat resistance and marproofness of light gage housings; gray metallic finish is decorative.

Thurmalox Co., Doylestown, Pa.
(a) THUR-MA-LOX finish in grey, green, white, black and aluminum.
(b) For spraying and brushing.
(c) Heat resisting on hot metal surfaces.

Tropical Paint & Oil Co., 1276 West 70th St., Cleveland.
(a) TROPELITE varnish (100 per cent Bakelite), available in clear, black and gray; A.C.B. primer and finishing coats in red, gray, and black.
(b) Tropelite can be applied by any method and is air dried; A.C.B. by brush or spray, also air dried.
(c) Tropelite is alkali, acid and moistureproof and A.C.B. is a rustproofing and decorative coating; both can be used on all kinds of machinery.

U

United Chromium Inc., 51 E. 42nd St., New York.
(a) UNICHROME alkaline copper plating; UNICHROME air dry coating in light gray; and UCILON lacquer in white, black, gray and green, also clear.
(b) Unichrome copper can be plated; air-dry coating applied by dipping; UCILON by brushing or dipping.
(c) The copper plating is for decorative and protective purposes; lacquer also is resistant to acids.

United Platers Inc., 991 Madison Ave., Detroit.
(a) UNIMATIC chrome, nickel, copper, cadmium, tin, zinc, lead, brass, bronze, stainless steel, aluminum anodizing, etc., finish.
(b) Plating, dipping, tumbling, hot lead coating, parkerizing, natural and oxidized finishes.
(c) Decorative, rustproofing, wear and heat resistant; for use on all kinds of machines.

United States Stoneware Co., Akron, O.
(a) TYGON acid and corrosion-proof finishes.
(b) Spray, brush, dip or roller coat.
(c) Corrosion, oil, waterproof; develops extremely hard surface on baking.

See advertisement, Page 113

W

Whitlam Mfg. Co., J. C., Wadsworth, O.
(a) VERTEX elastic enamel in aluminum gray.
(b) For brushing, spraying or dipping; air drying in 3 or 4 hours, or bake for 1 hour at 250 degrees Fahr.
(c) Oilproof, heat and light resistant; finish is for decorating, rustproofing, etc., on all types of machines.

Whittier Co., The Horace R., Pequabuck, Conn.
(a) WHITTIER porcelain enamel in all colors except metal colors.
(b) Spraying.
(c) Used for rustproofing, decoration and heat resistance on nameplates on all types of machines.

Directory of Materials

INDEX TO ADVERTISERS

OCTOBER, 1942

TITANIUM ALLOYS AVAILABLE

TAM

(F.C.T.) FERRO-CARBON-TITANIUM

FOR DEOXIDATION

TAM

40% FERRO-TITANIUM

FOR STAINLESS STEEL

TAM

FOUNDRY FERRO-TITANIUM

FOR IRON AND STEEL

There is no scarcity of TAM Titanium Alloys. Our expanded facilities enable us to fill orders for all requirements.

ISIT TAMCO'S BOOTH A-336
T THE NATIONAL METALS
XPOSITION, CLEVELAND
OCTOBER 12 TO 16

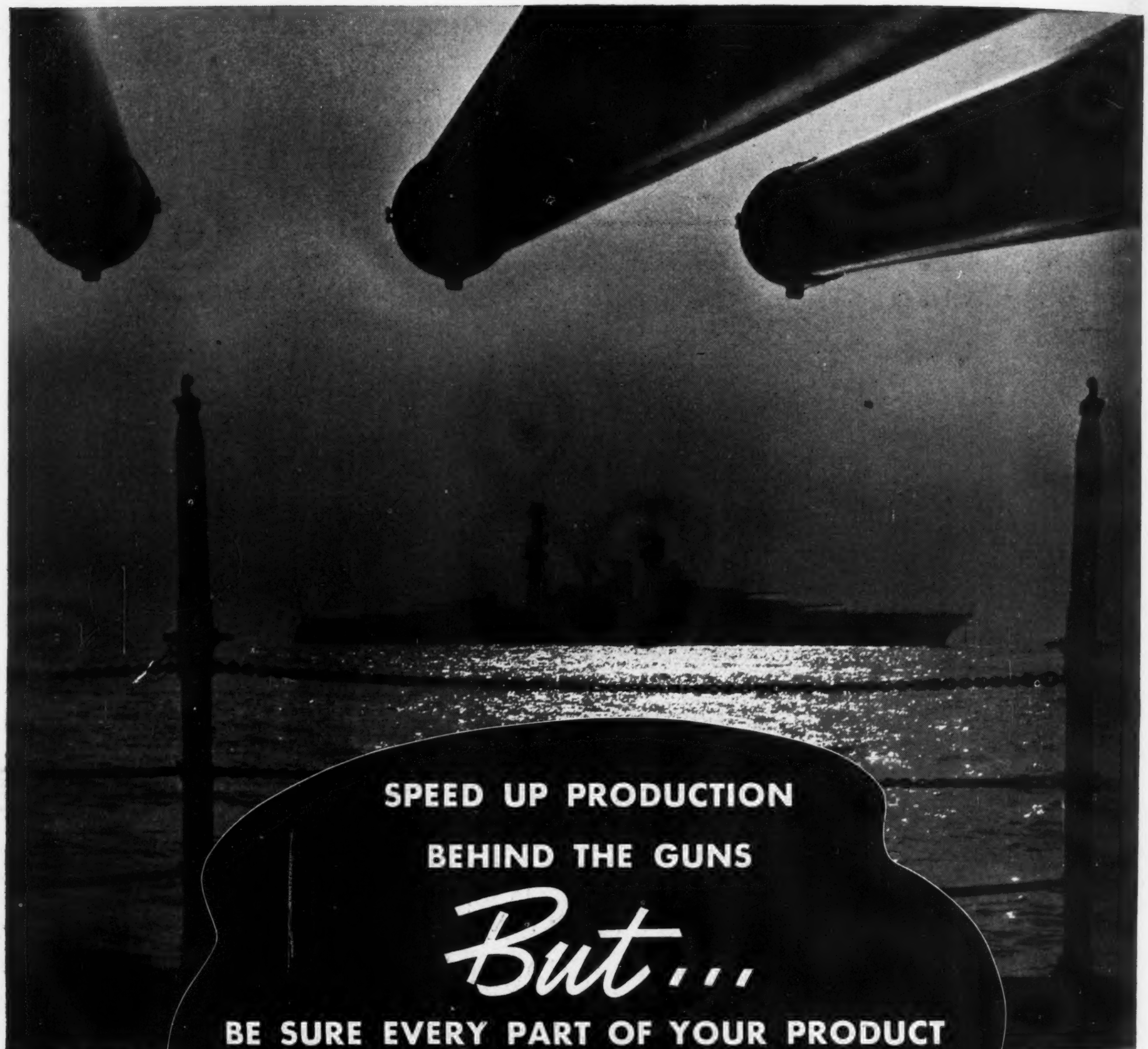
TAM
ZIRCONIUM AND TITANIUM PRODUCTS
Registered U. S. Pat. Off.

TITANIUM
ALLOY MANUFACTURING CO.

General Offices and Works: Niagara Falls, N. Y., U. S. A.
Executive Offices: 111 Broadway, New York City

Representatives for the Pacific Coast . . . BALFOUR, GUTHRIE & CO.
San Francisco, Los Angeles, Portland, Seattle, Tacoma
Representatives for Canada . RAILWAY & POWER ENG. CORP., Ltd.
Toronto, Montreal, Hamilton, Winnipeg, Vancouver, Sydney
Representatives for Europe . . . . T. ROWLANDS & CO., Ltd.
23-27 Broomhall St., Sheffield, England

TAM'S EXPERIENCED STAFF OF FIELD ENGINEERS WILL GLADLY EXPLAIN THE USES AND ADVANTAGES OF TITANIUM IN YOUR PRODUCTS



MACHINE DESIGN *Editorial*

Lack of Materials Still Threatens Success of War Program

RECENT intensification of scrap drives cannot fail to impress even the most optimistic with the drastic metals situation. These drives are not, as was the case to some extent with the earlier aluminum and paper collections, movements to stimulate patriotic thought and action. They are born of sheer necessity, as proved by the fact that only half the steel scrap, for instance, needed for the winter months is now on hand.

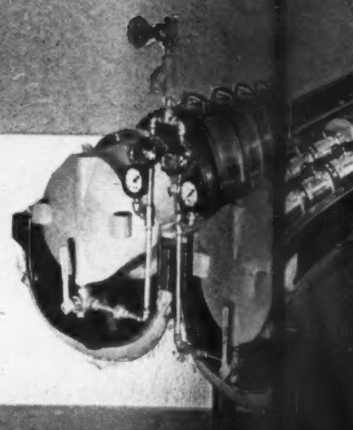
It has been claimed there is not an actual shortage of materials but that the current production difficulties arise from incorrect distribution brought about through some phases of the armament program having gone ahead faster than others. This obviously is true to a certain degree but it still does not mitigate the fact there *are* shortages of many materials—shortages that may seriously affect the success of the war program.

Designers in general are doing everything humanly possible in conservation and substitution. But individual cases continue to be rumored in which it seems clear that scarce materials are being used for purposes for which alternatives would be equally suitable. Such cases cannot all be ferreted out—it can only be left to the discretion and good judgment of the men and companies concerned to change over voluntarily to more available substitutes.

Alternative materials fortunately have come a long way since December 7, among the most outstanding being—as mentioned in a previous issue—the plastics and plastic-bonded plywood. Other materials such as powder metals and the national emergency steels follow closely in importance. All of these are listed and discussed in the directory included in this issue—a directory that this year more than ever before has been compiled to assist designers in solving the pressing problems with which they are faced in the selection of satisfactory materials. The codes of properties, cross-indexes and listings of available substitutes are included with the express purpose of easing the designer's increasingly heavy task in meeting his requirements while at the same time serving the national conservation program.

L. E. Jermy

Right—Necessity for making all parts of the Damrow all-metal cheese press completely sanitary led to the use of stainless steel troughs and galvanized steel slide rails for the cheese molds. To conserve critical materials, stainless steel is being replaced with galvanized iron for the duration of the war



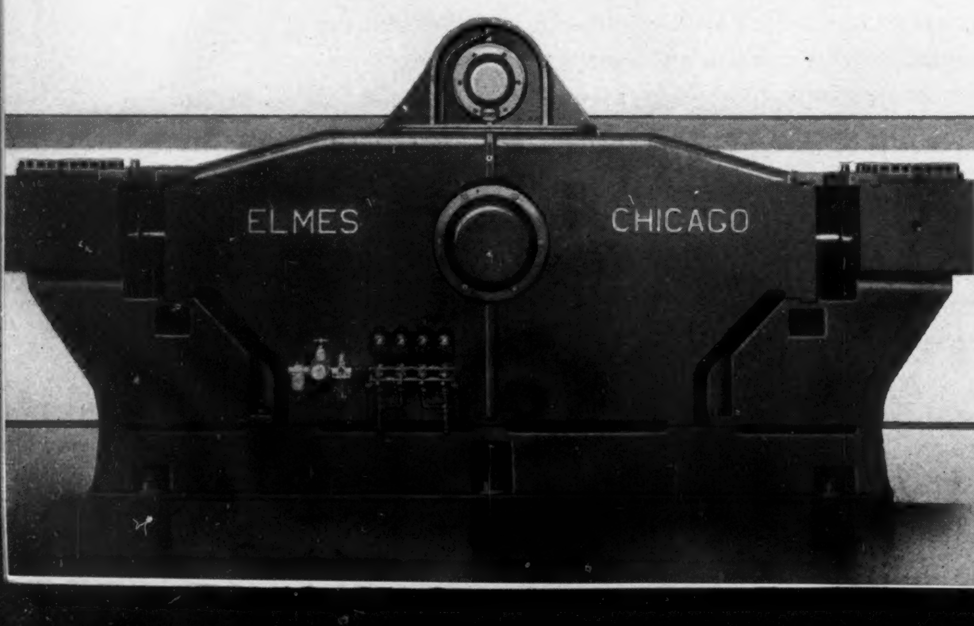
Above—Base and external housing of the Hydraulic Machinery flame hardening machine are of welded steel design. Control is electrical and the moving parts are hydraulically actuated. Working parts of the machine are shielded from the heat of the flame and the water used for quenching is completely sealed from the actuating mechanism

Machine Beh
the ns

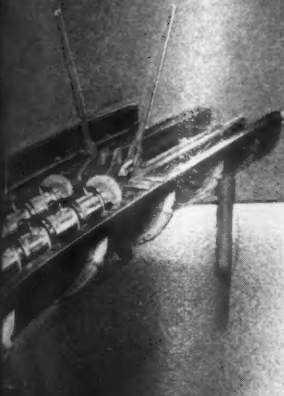
(For new machine listing, see pa

Right—Substitution of NE steels for high nickel alloys in work arbors of the new Michigan gear finisher conserves critical materials, while replacement of aluminum covers by transparent lucite panels in cast iron frames also aids conservation and permits inspection of the work during shaving. Flexible metallic hose carries the cutting fluid to and from the work, saving rubber formerly used for this purpose

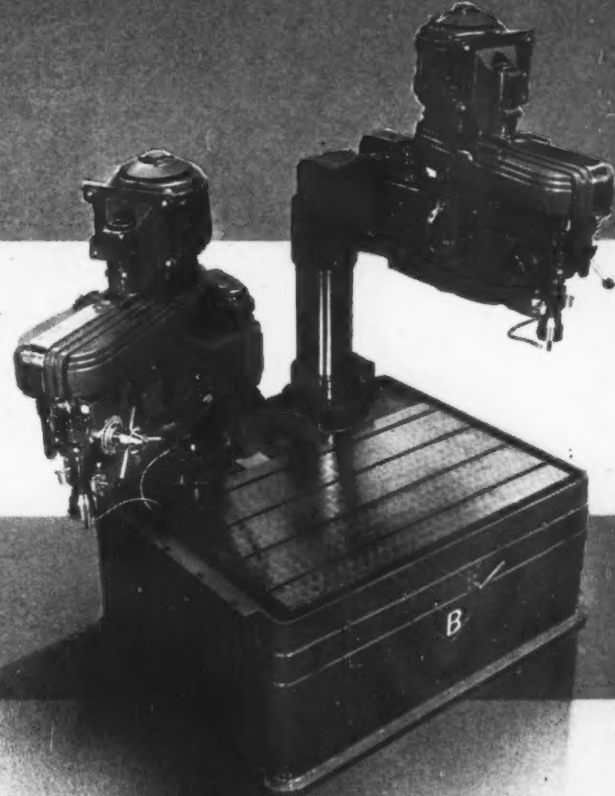
Below—Driven through herringbone gears, the 400-horsepower Elmes pump has six plungers of the full-floating type, nitrided to diminish wear. With only three eccentrics, due to the horizontally opposed design, the forged steel crankshaft is comparatively short, reducing deflections to a minimum



Above—Square frame de of the P & H-Hansen weld permits easy stacking of u for increased capacity. Rotor the motor generator is cast minum and the frame is of single-piece construction

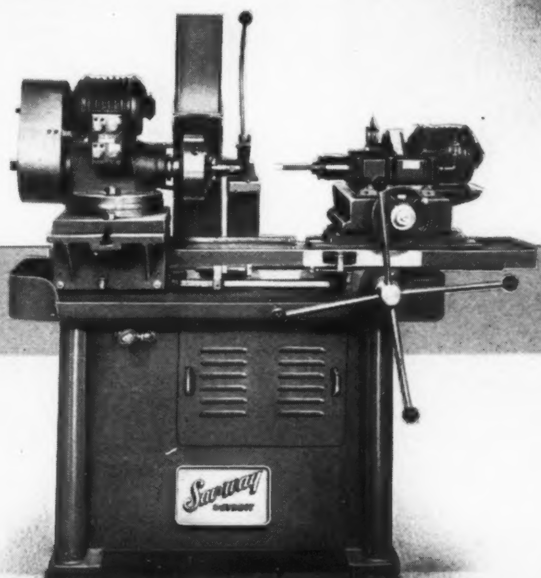


Right—Constructed of noncritical materials, the double-head Bakewell radial tapping machine is designed for flexibility and may be used for tapping two different sizes of holes, for working on two pieces or for drilling with one head and tapping with the other



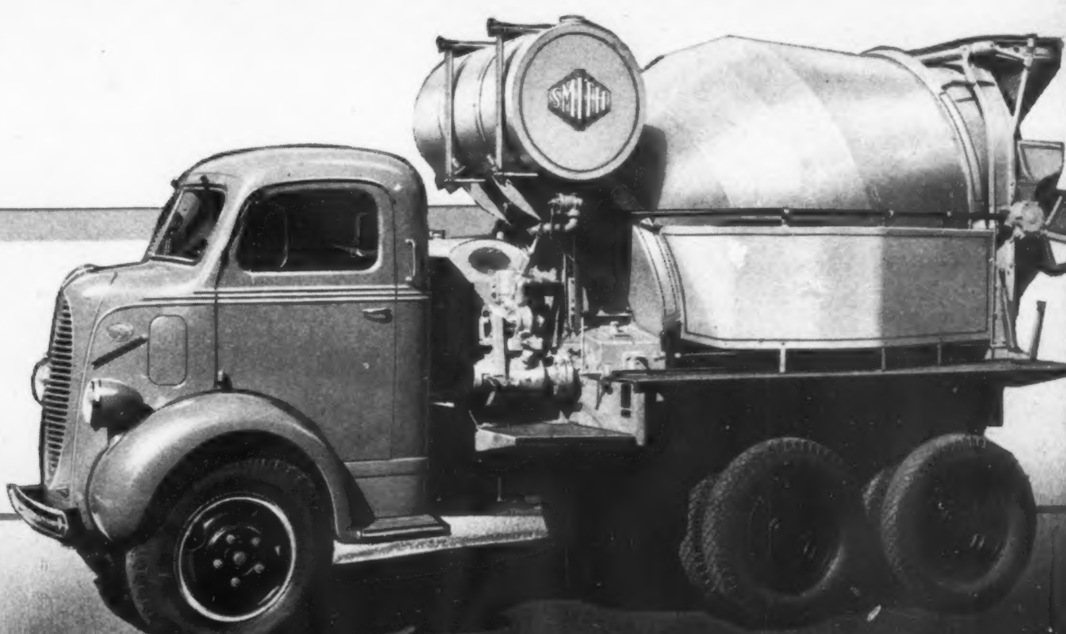
eBehind

ns



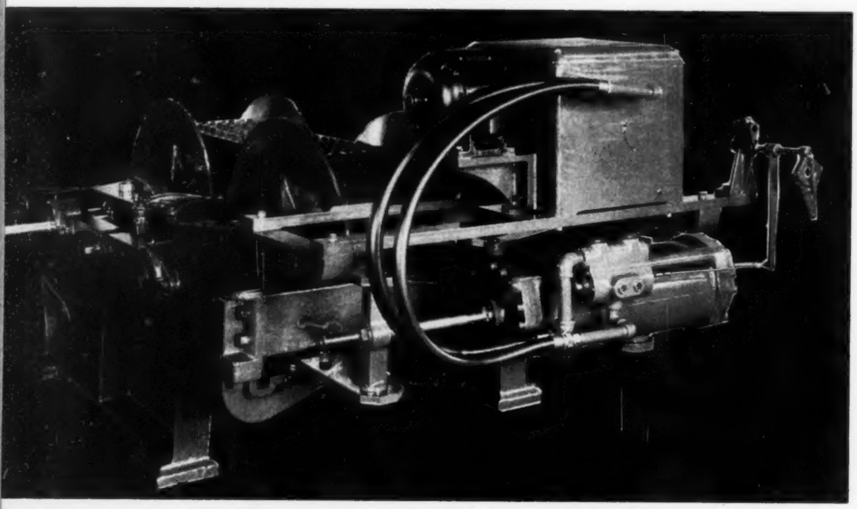
Left—Suitable for both toolroom and production grinding, the new Sav-way internal grinder handles a wider range of work than was possible on previous models. Headstock construction permits liberal adjustment at right angles to the wheel traverse

Below—Construction work on many projects allied to the war program is going forward with the aid of Smith-Mobile concrete mixers. Drums and other wearing parts, formerly of carbon steel, are now made of manganese steel for high abrasion resistance. Pinions are heat-treated chromium-molybdenum steel



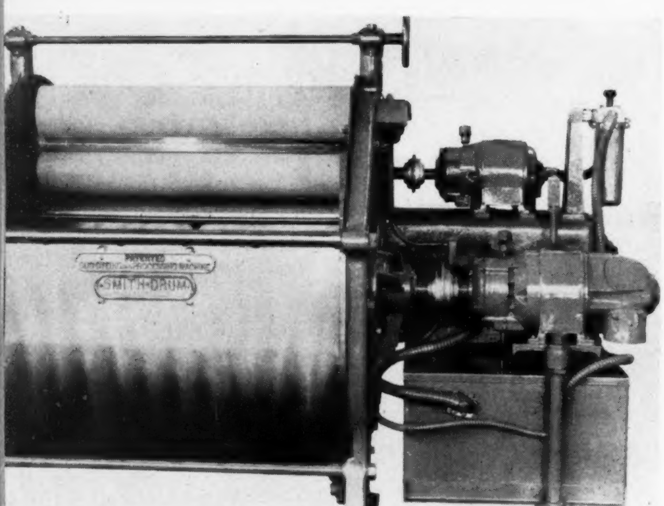
Applications

of Engineering Parts and Materials



Resists Oil Absorption

HOSE assemblies of Resistoflex are employed for the pressure and return lines on the Reeves hydraulically controlled variable speed transmission. Because it is unaffected by the hydraulic fluid it does not swell, thus insuring full flow at all times. Further, there is no possibility of contamination which might damage the valve mechanism. The material has a smooth surface which repels dirt, is flexible, shatterproof, heat resistant up to 212 degrees Fahr., and corrosion resistant to organic solvents.



Constant Cloth Tension Maintained

PREVENTION of defective dyeing caused by variations in cloth tension is effected by a constant-tension drive designed by General Electric engineers for the Duo-Dyeing Machine company. The cloth is propelled at constant speed by two nip rolls driven by a constant-speed gearmotor. Winding and unwinding are accomplished by means of wound-rotor induction motors, one direct connected to each of two winding rolls. The winding and unwinding motors are duplicates and operate with constant horsepower characteristics so that torque applied to the rolls is proportional to the roll diameter.

Internal Parts Fully Visible

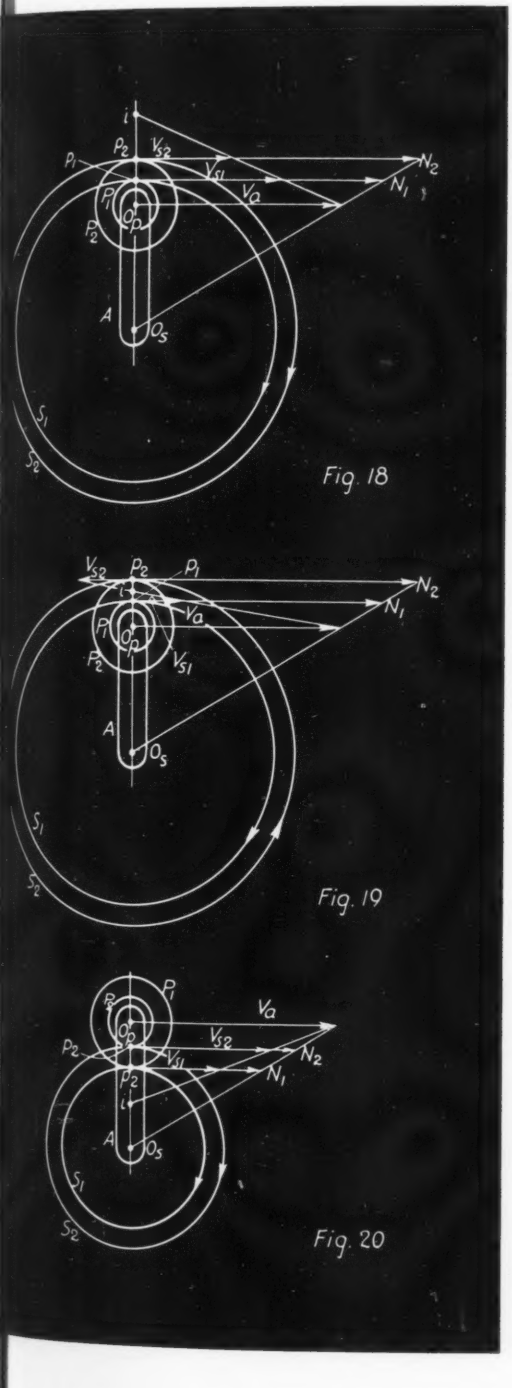
NOW being used for sight feeders and reagent heads on water purification equipment, transparent Crystalite moldings withstand chemicals such as hypochlorite solution, soda ash and alum, at the same time permitting full visibility of vital working parts. An acrylic base thermoplastic, the material is flexible and shock-resistant, with 4000 to 6000 pounds per square inch tensile strength and 1.18 specific gravity.

Graphical Analysis of Planetary Gear Systems—Part III

By Guy J. Talbourdet

Research Division

United Shoe Machinery Corporation



Compound Internal

Sun gears S_1 and S_2 driving clockwise, R_{s1} less than R_{s2}, V_{s1} greater than V_{s2}, arm A driven—Fig. 18

$$V_{s1}=\omega_{s1}R_{s1} \qquad V_{s2}=\omega_{s2}R_{s2}$$

$$\text{Then } V_a=\frac{V_{s1}R_{p2}-V_{s2}R_{p1}}{R_{p2}-R_{p1}} \qquad \omega_a=\frac{V_{s1}R_{p2}-V_{s2}R_{p1}}{R_a(R_{p2}-R_{p1})}$$

$$V_{e1}=V_{s1}-p_1N_1=R_{s1}(\omega_{s1}-\omega_a) \qquad V_{e2}=V_{s2}-p_2N_2=R_{s2}(\omega_{s2}-\omega_a)$$

$$\omega_p=\frac{R_{s1}}{R_{p1}}(\omega_{s1}-\omega_a)$$

Driven arm *A* rotates clockwise and planet pinions rotate counterclockwise.

Sun gear S_1 driving clockwise, sun gear S_2 driving counterclockwise, R_{s1} less than R_{s2}, arm A driven—Fig. 19

$$V_{s1}=\omega_{s1}R_{s1} \qquad V_{s2}=\omega_{s2}R_{s2}$$

$$\text{Then } V_a=\frac{V_{s1}R_{p2}+V_{s2}R_{p1}}{R_{p2}-R_{p1}} \qquad \omega_a=\frac{V_{s1}R_{p2}+V_{s2}R_{p1}}{R_a(R_{p2}-R_{p1})}$$

$$V_{e2}=-V_{s2}-p_2N_2=-R_{s2}(\omega_{s2}+\omega_a) \qquad V_{e1}=V_{s1}-p_1N_1=R_{s1}(\omega_{s1}-\omega_a)$$

$$\omega_p=\frac{R_{s1}}{R_{p1}}(\omega_{s1}-\omega_a)$$

Driven arm *A* rotates clockwise and planet pinions rotate counterclockwise

Compound External

Sun gears S_1 and S_2 driving clockwise, R_{s1} less than R_{s2}, V_{s1} less than V_{s2}, arm A driven—Fig. 20

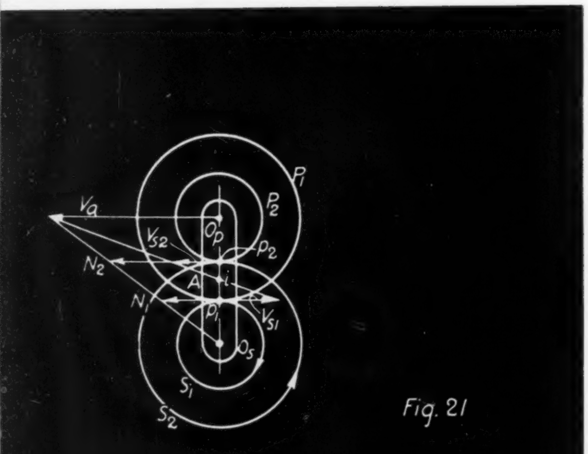
$$V_{s1}=\omega_{s1}R_{s1} \qquad V_{s2}=\omega_{s2}R_{s2}$$

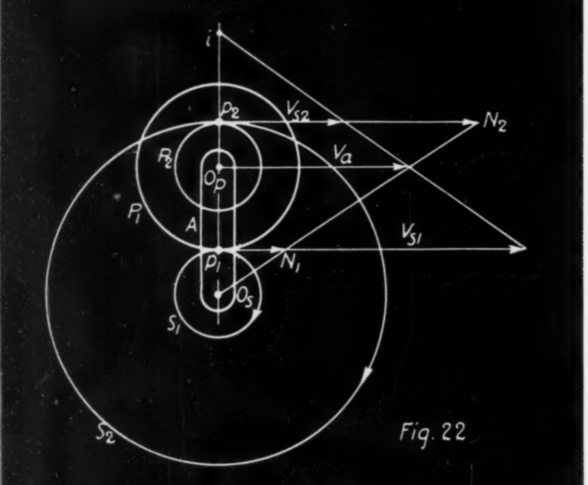
$$\text{Then } V_a=\frac{V_{s2}R_{p1}-V_{s1}R_{p2}}{R_{p1}-R_{p2}} \qquad \omega_a=\frac{V_{s2}R_{p1}-V_{s1}R_{p2}}{R_a(R_{p1}-R_{p2})}$$

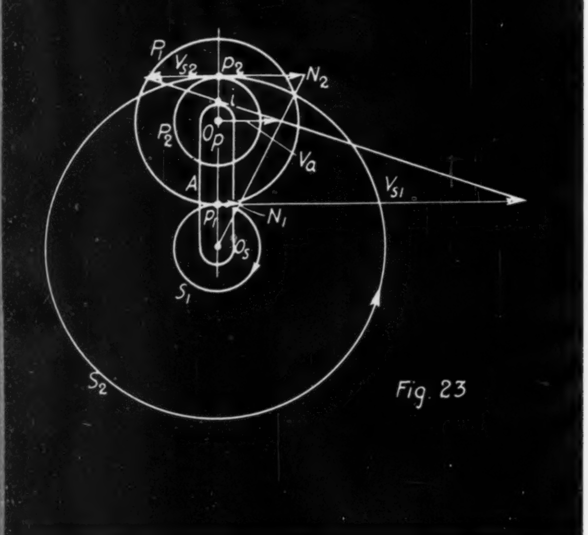
$$V_{e1}=V_{s1}-p_1N_1=R_{s1}(\omega_{s1}-\omega_a) \qquad V_{e2}=V_{s2}-p_2N_2=R_{s2}(\omega_{s2}-\omega_a)$$

$$\omega_p=\frac{R_{s1}}{R_{p1}}(\omega_{s1}-\omega_a)$$

Driven arm *A* rotates clockwise. When instantaneous axis *i* is above center O_s, planet pinions rotate clockwise and when *i* is below center O_s, planet pinions rotate counterclockwise.







Sun gear S_1 driving clockwise, sun gear S_2 driving counterclockwise, R_{s1} less than R_{s2}, arm A driven—Fig. 21

$$V_{s1}=\omega_{s1}R_{s1} \qquad V_{s2}=\omega_{s2}R_{s2}$$

$$\text{Then } V_a=\frac{V_{s2}R_{p1}+V_{s1}R_{p2}}{R_{p1}-R_{p2}} \qquad \omega_a=\frac{V_{s2}R_{p1}+V_{s1}R_{p2}}{R_a(R_{p1}-R_{p2})}$$

$$V_{e1}=V_{s1}-(-p_1N_1)=R_{s1}(\omega_{s1}+\omega_a) \qquad V_{e2}=-(V_{s2}-(-p_2N_2))=R_{s2}(\omega_a-\omega_{s2})$$

$$\omega_p=\frac{R_{s1}}{R_{p1}}(\omega_{s1}+\omega_a)$$

Driven arm A and planet pinions rotate counterclockwise.

Compound Internal and External

Sun gears S_1 and S_2 driving clockwise, V_{s1} greater than V_{s2}, arm A driven—Fig. 22

$$V_{s1}=\omega_{s1}R_{s1} \qquad V_{s2}=\omega_{s2}R_{s2}$$

$$\text{Then } V_a=\frac{V_{s1}R_{p2}+V_{s2}R_{p1}}{R_{p1}+R_{p2}} \qquad \omega_a=\frac{V_{s1}R_{p2}+V_{s2}R_{p1}}{R_a(R_{p1}+R_{p2})}$$

$$V_{e1}=V_{s1}-p_1N_1=R_{s1}(\omega_{s1}-\omega_a) \qquad V_{e2}=V_{s2}-p_2N_2=R_{s2}(\omega_{s2}-\omega_a)$$

$$\omega_p=\frac{R_{s1}}{R_{p1}}(\omega_{s1}-\omega_a)$$

Driven arm A rotates clockwise and planet pinions rotate counterclockwise

Sun gear S_1 driving clockwise, sun gear S_2 driving counterclockwise, V_{s1} greater than V_{s2}, $V_{s1}R_{p2}$ greater than $V_{s2}R_{p1}$, arm A driven—Fig. 23

For this case the instantaneous axis i is above center O_p.

$$V_{s1}=\omega_{s1}R_{s1} \qquad V_{s2}=\omega_{s2}R_{s2}$$

$$\text{Then } V_a=\frac{V_{s1}R_{p2}-V_{s2}R_{p1}}{R_{p1}+R_{p2}} \qquad \omega_a=\frac{V_{s1}R_{p2}-V_{s2}R_{p1}}{R_a(R_{p1}+R_{p2})}$$

$$V_{e1}=V_{s1}-p_1N_1=R_{s1}(\omega_{s1}-\omega_a) \qquad V_{e2}=-V_{s2}-p_2N_2=-R_{s2}(\omega_{s2}+\omega_a)$$

$$\omega_p=\frac{R_{s1}}{R_{p1}}(\omega_{s1}-\omega_a)$$

Driven arm A rotates clockwise and planet pinions rotate counterclockwise.

Sun gears S_1 and S_2 driving clockwise, V_{s1} greater than V_{s2}, arm A and sun gear S_3 driven—Fig. 24

$$V_{s1}=\omega_{s1}R_{s1} \qquad V_{s2}=\omega_{s2}R_{s2}$$

$$\text{Then } V_a=\frac{V_{s1}R_{p2}-V_{s2}R_{p1}}{R_{p2}-R_{p1}} \qquad \omega_a=\frac{V_{s1}R_{p2}-V_{s2}R_{p1}}{R_a(R_{p2}-R_{p1})}$$

$$V_{s3}=\frac{2V_{s1}R_{p2}-V_{s2}(R_{p1}+R_{p2})}{R_{p2}-R_{p1}} \qquad \omega_{s3}=\frac{2V_{s1}R_{p2}-V_{s2}(R_{p1}+R_{p2})}{R_{s3}(R_{p2}-R_{p1})}$$

$$V_{e1}=V_{s1}-p_1N_1=R_{s1}(\omega_{s1}-\omega_a)$$

$$V_{e2}=V_{s2}-p_2N_2=R_{s2}(\omega_{s2}-\omega_a)$$

$$V_{e3}=V_{s3}-p_3N_3=R_{s3}(\omega_{s3}-\omega_a)$$

$$\omega_p=\frac{R_{s1}}{R_{p1}}(\omega_{s1}-\omega_a)$$

Driven arm A and sun gear S_3 rotate clockwise, planet pinions rotate counterclockwise.

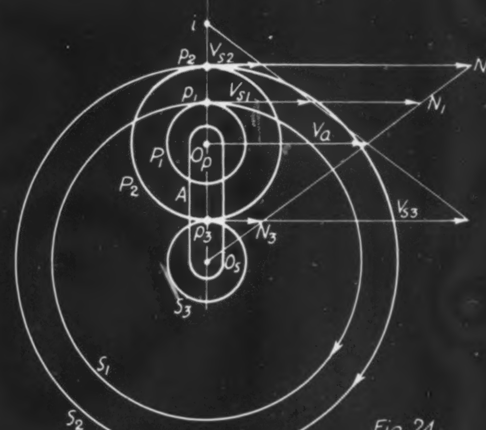


Fig 24

Compound External with Idler Planet

Sun gears S_1 and S_2 driving clockwise, R_{s1} less than R_{s2} arm A driven—Fig. 25

$$V_{s1}=\omega_{s1}R_{s1} \qquad V_{s2}=\omega_{s2}R_{s2}$$

$$\text{Then } \omega_a=\frac{\omega_{s1}R_{s1}+\omega_{s2}R_{s2}}{R_{s1}+R_{s2}}$$

$$V_e=V_{e1}=V_{e2} \qquad V_{e1}=R_{s1}(\omega_{s1}-\omega_a) \qquad V_{e2}=R_{s2}(\omega_{s2}-\omega_a)$$

$$\omega_{p1}=\frac{R_{s1}}{R_{p1}}(\omega_{s1}-\omega_a) \qquad \omega_{p2}=\frac{R_{s1}}{R_{p2}}(\omega_{s1}-\omega_a)$$

Driven arm A rotates clockwise. When ω_{s1} is greater than ω_a, planet pinion P_1 rotates counterclockwise and P_2 rotates clockwise. When ω_{s1} is less than ω_a, P_1 rotates clockwise and P_2 rotates counterclockwise.

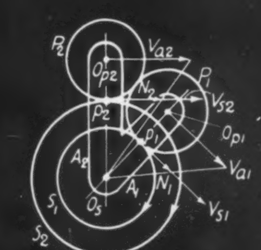


Fig. 25

Sun gear S_1 driving clockwise, sun gear S_2 driving counterclockwise, R_{s1} less than R_{s2}, arm A driven—Fig. 26

$$V_{s1}=\omega_{s1}R_{s1} \qquad V_{s2}=\omega_{s2}R_{s2}$$

$$\text{Then } \omega_a=\frac{\omega_{s1}R_{s1}-\omega_{s2}R_{s2}}{R_{s1}+R_{s2}}$$

$$V_{e1}=R_{s1}(\omega_{s1}-\omega_a) \qquad V_{e2}=R_{s2}(-\omega_{s2}-\omega_a)$$

$$\omega_{p1}=\frac{R_{s1}}{R_{p1}}(\omega_{s1}-\omega_a) \qquad \omega_{p2}=\frac{R_{s1}}{R_{p2}}(\omega_{s1}-\omega_a)$$

When $\omega_{s1}R_{s1}$ is greater than $\omega_{s2}R_{s2}$, driven arm A and pinion P_2 rotate clockwise while planet pinion P_1 rotates counterclockwise. When $\omega_{s1}R_{s1}$ is less than $\omega_{s2}R_{s2}$, driven arm A and planet pinion P_1 rotate counterclockwise while pinion P_2 rotates clockwise.

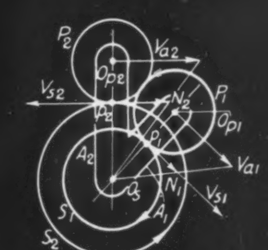


Fig. 26

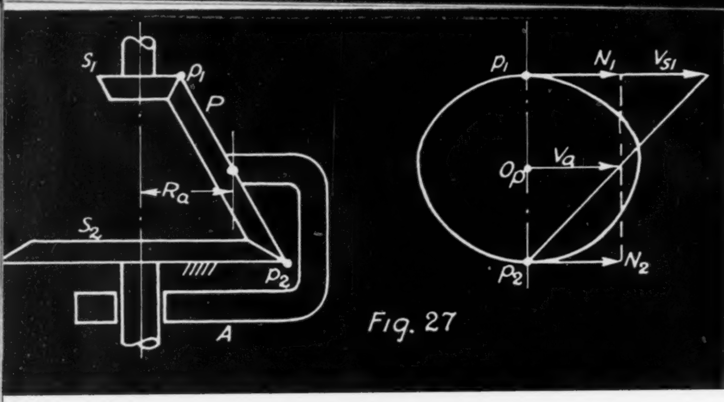


Fig. 27

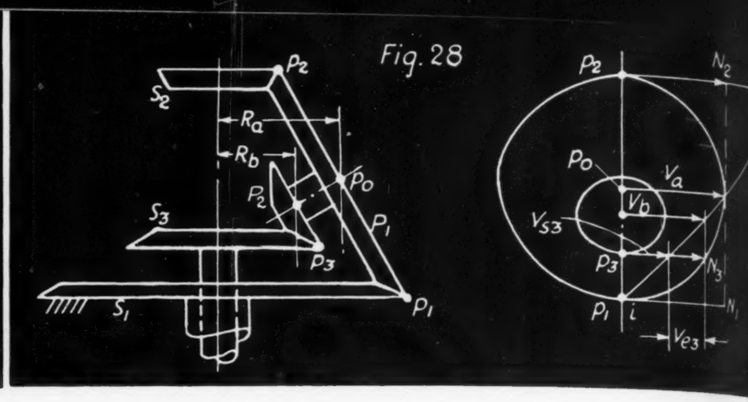


Fig. 28

Simple Bevel Planetary

Sun gear S_1 driving clockwise, sun gear S_2 fixed, arm A driven—Fig. 27

$$\omega_{s2}=0 \qquad V_{s1}=\omega_{s1}R_{s1} \qquad R_a=\frac{R_{s1}+R_{s2}}{2} \qquad V_a=\frac{V_{s1}}{2}$$

Angular velocity of driven arm A is $\omega_a=\dfrac{\omega_{s1}R_{s1}}{R_{s1}+R_{s2}}$

Pitch line velocity of tooth engagement of sun gear S_1 and planet pinion P is $V_{e1}=V_{s1}-p_1N_1=\dfrac{\omega_{s1}R_{s1}}{2}$

Pitch line velocity of tooth engagement of sun gear S_2 and planet pinion P is $V_{e2}=0-p_2N_2=-\dfrac{\omega_{s1}R_{s1}}{2}$

Angular velocity of planet pinions is $\omega_p=\dfrac{\omega_{s1}R_{s1}}{2R_p}$

Driven arm A and planet pinion P rotate clockwise.

Compound Bevel Planetary

Sun gear S_2 driving clockwise, sun gear S_1 fixed, arm A and sun gear S_3 driven—Fig. 28

Following the notation in *Fig.* 28, it is evident from the geometry of the figure that

$$\omega_{s1}=0 \qquad V_{s2}=\omega_{s2}R_{s2} \qquad V_a=\frac{V_{s2}}{2} \qquad R_a=\frac{R_{s1}+R_{s2}}{2}$$

Angular velocity of driven arm A is $\omega_a=\dfrac{\omega_{s2}R_{s2}}{R_{s1}+R_{s2}}$ **Speed ratio is** $\dfrac{\omega_a}{\omega_{s2}}=\dfrac{R_{s2}}{R_{s1}+R_{s2}}$

Pitch line velocity of tooth engagement of sun gear S_2 and planet pinion P_1 is $V_{e2}=V_{s2}-p_2N_2=\dfrac{\omega_{s2}R_{s2}}{2}$

Pitch line velocity of tooth engagement of sun gear S_1 and planet pinion P_1 is $V_{e1}=0-p_1N_1=-\dfrac{\omega_{s2}R_{s2}}{2}$

Angular velocity of planet pinions is $\omega_p=\dfrac{\omega_{s2}R_{s2}}{2R_p}$

Also $V_b=\dfrac{V_aR_b}{R_a}$ **and** $R_b=R_{s3}-\dfrac{R_{p2}}{R_{p1}}(R_{s1}-R_a)$, **therefore** $V_b=\dfrac{V_{s2}R_b}{2R_a}=\dfrac{\omega_{s2}R_{s2}R_b}{2R_a}$

Pitch line velocity of tooth engagement of planet pinion P_2 and sun gear S_3 is $V_{e3}=\dfrac{V_{e1}R_{p2}}{R_{p1}}=-\dfrac{\omega_{s2}R_{s2}R_{p2}}{2R_{p1}}$

Pitch line velocity of sun gear S_3 is $V_{s3}=V_b+V_{e3}=\dfrac{\omega_{s2}R_{s2}}{2}\left(\dfrac{R_b}{R_a}-\dfrac{R_{p2}}{R_{p1}}\right)$

Angular velocity of driven sun gear S_3 is $\omega_{s3}=\dfrac{\omega_{s2}R_{s2}}{2R_{s3}}\left(\dfrac{R_b}{R_a}-\dfrac{R_{p2}}{R_{p1}}\right)$

Speed ratio between sun gears S_2 and S_3 is $\dfrac{\omega_{s3}}{\omega_{s2}}=\dfrac{R_{s2}}{2R_{s3}}\left(\dfrac{R_b}{R_a}-\dfrac{R_{p2}}{R_{p1}}\right)$

Speed ratio between arm A and sun gear S_3 is $\dfrac{\omega_{s3}}{\omega_a}=\dfrac{R_a}{R_{s3}}\left(\dfrac{R_b}{R_a}-\dfrac{R_{p2}}{R_{p1}}\right)$

Driven arm A and planet pinions rotate clockwise.

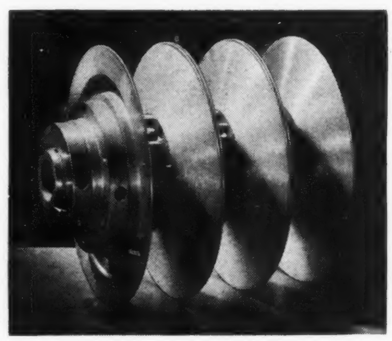
When V_b is greater than V_{e3}, sun gear S_3 rotates clockwise.

When V_b is less than V_{e3}, sun gear S_3 rotates counterclockwise.

New PARTS AND MATERIALS

Sheave with Speed Variations

WARTIME demands for power transmission in wider ranges of speed variation have stimulated the design of a new wide-range* vari-pitch sheave by Allis-Chalmers Mfg. Co., Milwaukee. Speed variations from 66 to 116 per cent are possible with the new sheave which is used with a companion sheave grooved for the new wide Texrope V-belts. The sheaves are manufactured in sizes to fit shafts of all



standard NEMA motors from fractional to 30 horsepower. Companion sheaves are made in sizes to meet the applications requirements. The speed variation of the new sheaves provides a flexibility which is proving adaptable in machine tool and textile machinery applications.

Four-Way Hydraulic Valves

COMPLETING its line of valves, Bendix Aviation Ltd., North Hollywood, Calif., has introduced two new four-way hydraulic selector valves. With the addition of this type the company now covers every tube size and style from ¼ to ⅜-inch. The two new valves (Assembly 401799) for ⅜-inch tube size with integral check, and (Assembly 402506) relief valve for ⅜-inch tube size, are of radial design and have fewer parts, and pressure drop is exceptionally low. Equipped with plastic poppets, smooth, quiet operation at all flows is assured. The plastic poppets weigh only one-sixth as much as comparable steel poppets. There are a total of nine models in the comany's line including dual and triple bank valves. These combinations duplicate the

Positive, Continuous Operation–

Vital Then–Indispensable Now!

More than 12 years ago an Eastern manufacturer selected Cleveland Worm Gear Speed Reducers for the important drives throughout his large Mill, and now tells us:—

"*Cleveland Drives have given positive and continuous operation.*"

For over 12 years—24 hours a day—355 days a year—not just one Cleveland but more than 50 of them have kept this manufacturer's machines in steady production.

Install Clevelands on the equipment you build, and you will keep *your* machines in steady production too—with assurance of continuous, trouble-free performance through many years to come.

Your Clevelands will never let you down!

The Cleveland Worm & Gear Company, 3265 East 80th Street, Cleveland, Ohio.

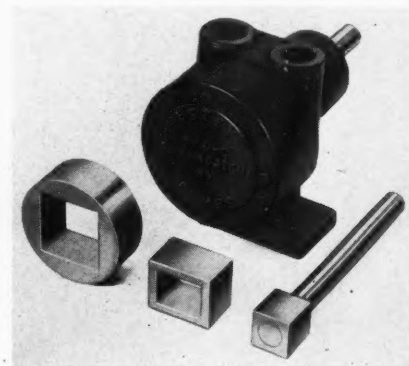
Affiliate: The Farval Corporation, Centralized Systems of Lubrication
In Canada: PEACOCK BROTHERS LIMITED

CLEVELAND
WORM GEAR *Speed Reducers*

basic design which is the only one permitting use of co-axial shafts, allowing all handles to be operated simultaneously when desired.

Pump for Thick or Thin Coolants

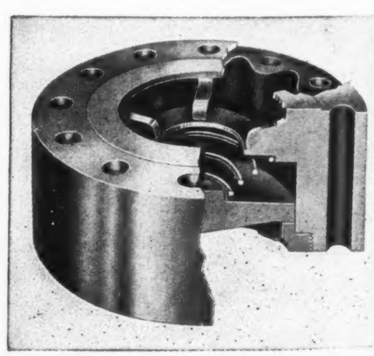
DESIGNED to pump either thin or thick coolants without priming each time machine is started, The Estey Pump Co., Canandaigua, N. Y., has placed on the market its Model C coolant pump. The only three moving parts in the pump are so arranged that pumping action is obtained by the equivalent of practically four pistons operating within a circular area. Pumping action is positive and pump can be operated



in either direction. The two moving parts, made of similar metal, are separated by the third of a different metal, thus tending to reduce friction and lengthening the life of pump. Pump has S.A.E. standard base mounting of 2¼ x 4 inches. Ports are tapped for ¾-inch pipe thread, and capacity of pump is 3 to 12 gallons per minute at 300 to 1200 revolutions per minute.

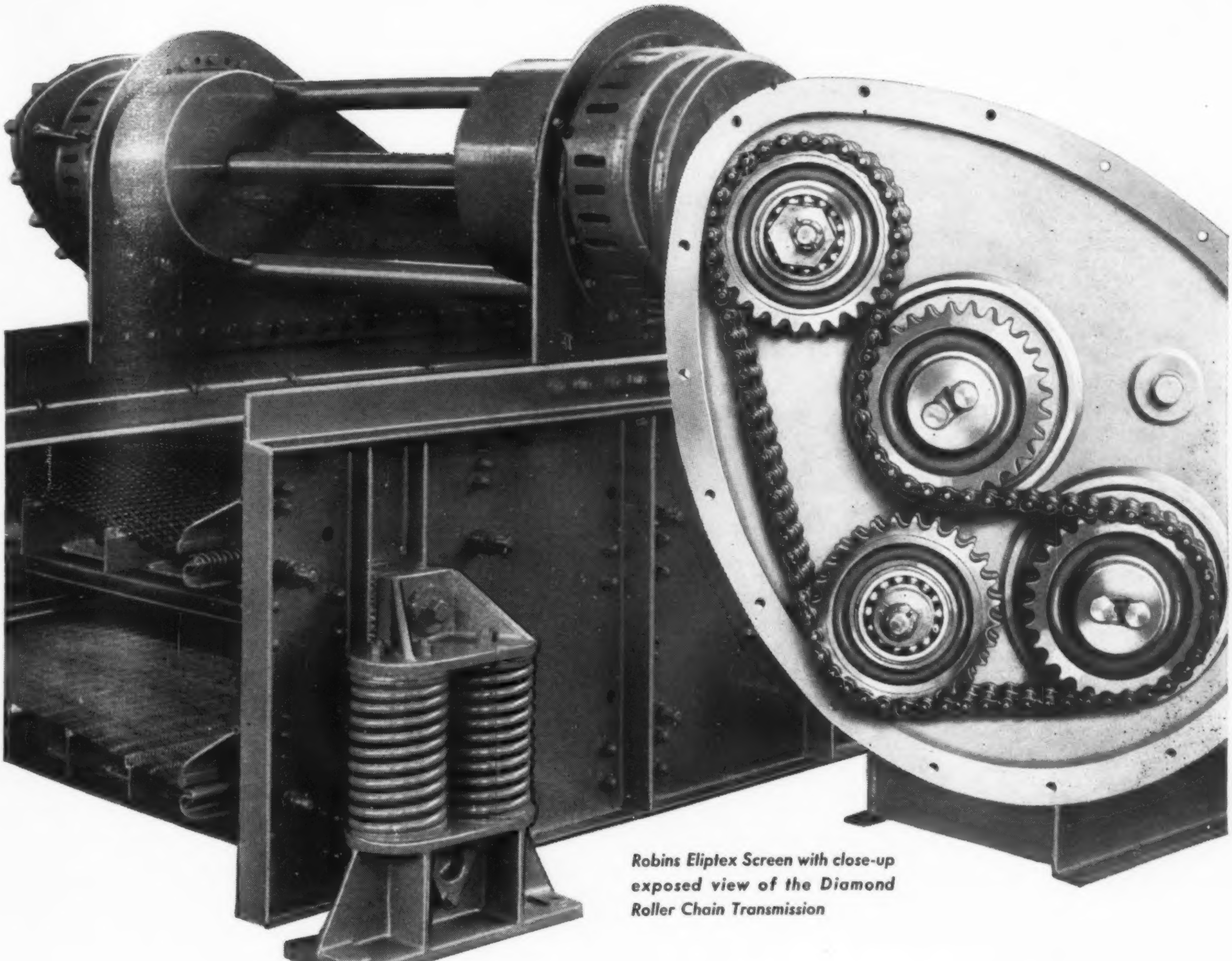
Flanged Silent Check Valves

FURNISHED in a wide variety of metals and sizes, an improved line of check valves is being introduced by The Williams Gauge Co., 2037 Pennsylvania avenue, Pittsburgh. Known as the Williams-Hager flanged silent check valves, they are of bronze, cast



iron, steel, stainless and monel metal, for pressures varying from 150 to 2500 pounds to meet American Standard specifications. Range of sizes is from 1 to 20

(*Continued on Page* 220)



Robins Eliptex Screen with close-up exposed view of the Diamond Roller Chain Transmission

ANOTHER "TOUGHIE" WHIPPED

● About two years ago spur gears were applied to the vibrating mechanism of a small screen but when the same system was adopted for 28 large Eliptex screens, gears began to fail until all 28 were having operating difficulties.

The designing engineer believed a roller chain transmission could be designed for this unusual job. Altho several chain engineers considered the job "too tough,"—a DIAMOND Roller Chain system was devised which completely solved the problem. The DIAMOND transmission consists of two driver sprockets, an adjustable idler sprocket mounted on an eccentric and another idler to maintain satisfactory wrap of the Diamond double strand roller chain employed. This transmission drives two shafts in opposite directions at high speed, each shaft carrying unbalanced weights, the compound centrifugal force giving the screen its elliptical motion.

All of the original 28 Eliptex screens were fitted with DIAMOND transmissions as well as one hundred new ones. All have been in service from one to two years without a single chain replacement required—another example of resourceful machinery designers' use of Diamond Roller Chains.

Whether for driving production machinery, or as built-in drives on machines themselves, DIAMOND Roller Chains insure maximum efficiency, dependable performance, top production output. With 52 years of experience in roller chain applications, our engineers can help you to quickly arrive at a satisfactory drive,—even where it may look as if "It Can't Be Done."

DIAMOND CHAIN & MFG. CO., 435 Kentucky Avenue, Indianapolis, Indiana. Offices and Distributors in All Principal Cities.

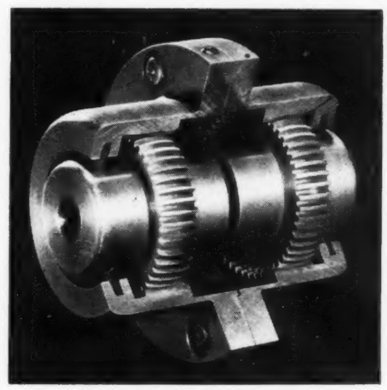
DIAMOND ROLLER CHAINS

(*Continued from Page* 214)

inches. Only two parts of the valves are subject to wear, the valve disk and seat, but both are easily removable and renewable. The spring ring is now being built as an integral part of the body. For use in equipment for waterworks, oil refineries and chemical works, as well as in air conditioning and hydraulic systems the simple, compact and rugged valves may be used in all types of pump lines.

Aligning Shaft Gear Coupling

FOR aeronautical and general machinery use, a new coupling involving misaligning latitude not previously accomplished in gear couplings will be of interest to designers. Announced by Barcus Engineering Co., 3931 Falls road, Baltimore, the coupling comprises a cylindrical housing shell cut with internal gears having stub teeth with 20 degrees pressure angle. Driving and driven shafts respectively are connected to hubs of generated gears each cut on a true central segment of a sphere, the surface of teeth being of constant width



throughout their length. Friction and pressure on shaft bearings, if the shafts are out of alignment, are reduced by the teeth of each spherical gear meshing in the stub teeth of the housing, producing a smooth ball action. The specially designed spherical gear is in full mesh on pitch line with internal gear at all times and with maximum reduction of backlash. Nature of the gear permits misalignment up to 3 degrees on either shaft, or a total misalignment of 6 degrees.

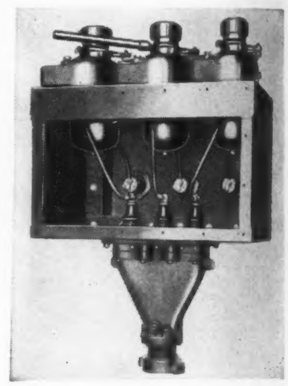
Swivels Available in Two Types

STRAIGHT and 90-degree angle swivels for making oil, grease, air and other connections between stationary, moving or oscillating surfaces are being

offered by Trabon Engineering Corp., 1814 East Fortieth street, Cleveland. Available in two different constructions for various requirements, standard ball bearing swivels can be had in ⅛, ¼, ⅜, ½ and ¾-inch pipe sizes. Because of the ball bearing construction the swivels turn freely at any pressure without binding. Light-duty swivels are built without balls, and are intended for use in lighter work when space limitations do not permit use of the standard ball bearing swivels. These are offered in ⅛ and ¼-inch sizes. Right-hand threads in both head and stem are furnished in both types of swivels, while left-hand threads in either the head or stem, or in both, can be furnished upon request.

Metal-Enclosed Cutout Assemblies

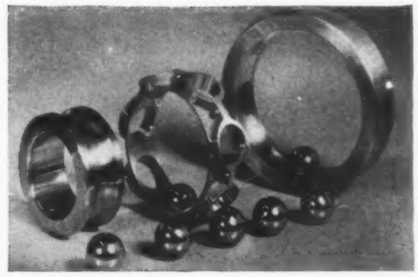
ANNOUNCED by General Electric Co., Schenectady, N. Y., the new metal-enclosed assembly of gang-operated oil fuse cutouts for short-circuit protection and switching are particularly adapted for in-industrial plants for branch circuits, individual transformers or banks, motors, control apparatus, and electric-heating and other equipment. The new assemblies permit totally metal-enclosed installations, either single or three-phase. Because each unit is factory-assembled with flexible, insulated cable leads ready for connection to either single or multiconductor cable, installation is easy. Leads enter individual cutouts above oil level, preventing loss of oil. For switching, a level is thrown 90 degrees. Fuse carriers can be removed without disturbing the gang-operating mechanism. Supplied for direct-to-apparatus mounting, with openings for conduit, cable or pothead connections, the assemblies are available in the following ratings: For short-circuit protection and switching, 2500 volts at 100, 200 and 300 amperes; 5000 volts at 50 and 100 amperes and 7500 volts at 100 amperes. For switching only (copper blade instead of fuse link), 2500 volts at 150, 250 and 350 amperes; 5000 volts at 150 and 250 amperes, and for 7500 volts at 150 amperes. In the illustration cover is removed to show cutout connections.



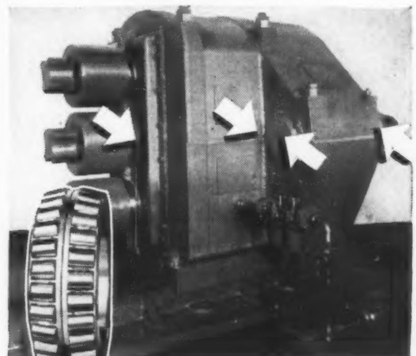
Steel Is Hard and Tough

WHERE extreme toughness is required above other characteristics, Jessop Steel Co., Washington, Pa., is furnishing a water-hardening steel known as "Jessop RT". Its unusual toughness and strength enables the material to give very good performance; it has enough ductility to stretch more than 4 per cent before it will break. On proper treated steel, breaking strength is 323,000 pounds per square inch, and elongation in 2 inches is 4.5 per cent. When large and medium sizes are hardened, the material acquires a hard case and tough core. A 1½-

EYES OF THE ANTI-AIRCRAFT BATTALIONS, giant searchlights like this will pierce the skies with 800-million-candlepower beams to track down hostile planes. Among the advanced engineering features incorporated in the design of this searchlight is the use of Bantam Quill Bearings to assure high capacity, efficient operation, and long life at vital points in the trailer mechanism. Here is another instance of the many ways in which Bantam Bearings are contributing to the successful functioning of America's war equipment.

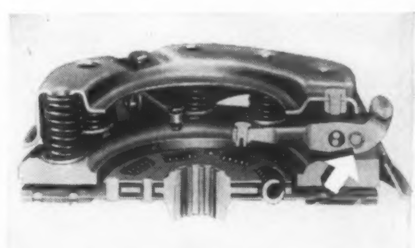


ABILITY TO MEET SPECIAL REQUIREMENTS in bearing design is an important aspect of Bantam's service to industry. In addition to a comprehensive line of standard anti-friction bearings—straight roller, tapered roller, needle, and ball—Bantam offers a highly developed skill in the design and production of unusual types, such as this ball radial bearing. If you have a difficult bearing problem, TURN TO BANTAM.



SMOOTH, UNFAILING POWER for a three-high copper rod mill is transmitted by this special drive combined with a three-high pinion stand, built by Farrel-Birmingham Company, Inc. Bantam two-row tapered roller bearings are used both on the high-speed shaft of the gear reduction unit and on the center pinion of the three-high stand.

41,000 IN USE WITHOUT A SINGLE FAILURE is the remarkable service record established by Bantam Quill Bearings in the pumping units and pumping jacks built by the National Supply Co. Though subjected to the severe operating conditions of oil field service, the Quill Bearings have been performing with this consistent dependability for periods as long as five years. For further details on these compact, high-capacity, anti-friction bearings, write for Bulletin B-104.



REDUCTION IN PEDAL PRESSURE is made possible through the use of Bantam Needle Rollers to form a compact, high-capacity anti-friction unit in the lever assembly of clutches produced by Long Manufacturing Division of Borg-Warner Corporation. Efficient lubrication throughout the life of the unit is an added advantage of these bearings.

BANTAM BEARINGS

STRAIGHT ROLLER · TAPERED ROLLER · NEEDLE · BALL

BANTAM BEARINGS CORPORATION • SOUTH BEND • INDIANA

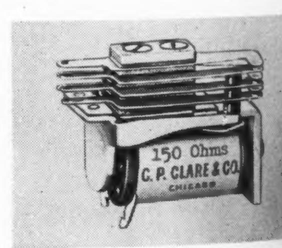
inch piece will have a fine-grained case approximately 3/16 to ¼-inch deep with hardness of about C-61/63 Rockwell. Smaller sizes—under ¾-inch—will harden throughout.

Temporary Coating Offered

NONADHESIVE formulations produced by The United States Stoneware Co., Akron, O., provide easily removed, temporary protection to highly polished surfaces against rust, corrosion, grease, finger markings, dust, scratches, etc. Consisting of pure Tygon, liquefied to form a nonadhesive film when dried, this formation known as "Tygon Temprotec", is crystal clear or transparent colored, ready for identification purposes. It is applied by brush, dip, spray or roller coating. The finish dries by air within a few minutes at normal room temperature into a finish unaffected by oil, grease, gasoline or corrosive atmospheric fumes or condensates. In sunlight the finish will not become brittle. It can easily peel off, leaving the surface beneath uninjured. The coating provides an excellent protection for surfaces of machine parts such as bearings, etc., during handling, shipping and installation.

Aircraft Relay Light in Weight

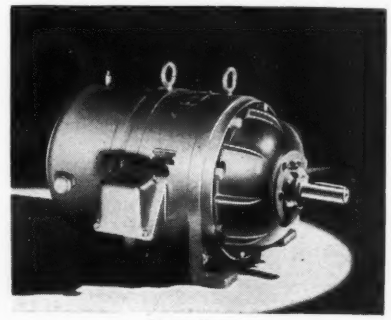
AN extremely small "k" direct-current relay, measuring 1½ x 1¼ x 13/16 inches and weighing approximately 1-2/3 ounces, has been announced by C. P. Clare & Co., 4719 Sunnyside avenue, Chicago. It can be used wherever minimum weight and space is a factor, and is furnished in any of the contact forms or combinations up to and including 12 springs per relay. Range of coil voltage is from 1.5 to 60 volts direct current. Contacts of either 18-gage silver, which are rated one ampere 50 watts, or 18-gage palladium, rated two amperes 100 watts, are available. Custom built to specifications, if desired, the relay has been particularly designed for aircraft use to withstand severe vibration and shock. Pile-up screws are tightened under pressure and secured into heelpiece by a coating of insulating lacquer.



Motor Resists Magnesium Dust

TO MEET a need brought about by the extensive use of magnesium and aluminum in war production, General Electric company has developed a new line of polyphase induction motors in sizes from 1 to 20 horse-

power, NEMA frames 203 to 326 inclusive, for use under magnesium dust conditions. Suitable for Class II, Group E locations, the motors in many cases are subjected to magnesium and aluminum metals in the form of fine powder, as used in incendiary bombs and for other military purposes, or from castings during grinding or polishing operations. The motors are totally enclosed,



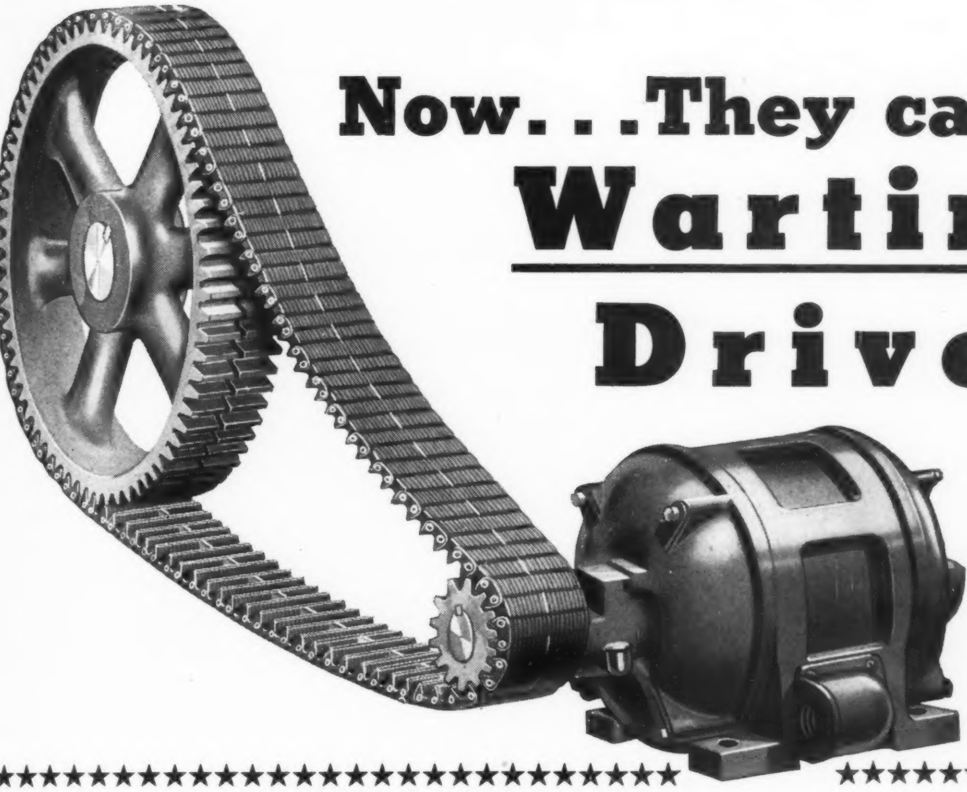
with a nonventilated construction in smaller ratings and a fan-cooled construction above two horsepower. Dust-tightness is made possible by simple cast-iron end shields, stator frames and fan housings, without complicating assembly or disassembly. Other features of the motors are nonsparking bronze external fans, relatively straight and smooth external ventilating passages to facilitate cleaning, permanently sealed-in leads, and a rotating labyrinth seal at the shaft opening.

Right-Angle Nuts Developed

NEW angle anchor speed nuts for blind right-angle attachments have been developed by Tinnerman Products Inc., 2085 Fulton road, Cleveland. Combining a standard "U" type speed nut with a cadmium-plated angle bracket for right-angle attachments where access is only from one side, the nuts are available for use with 6-32 and 8-32 machine screws and 4Z, 6Z and 8Z sheetmetal screws. The nuts can also be obtained in 86, 90 and 94-degree angles. Ideally suited to the attachment of junction box covers, switch box covers, fairings and many other angular attachments, the fasteners provide double-locking, spring-tension grip that permanently resists vibration. Standard shape and rivet hole spacings make the fasteners interchangeable with other angle anchor self-locking nuts.

Relay Controls for Aircraft

RAPIDLY expanding requirements of the aircraft industry for relay controls has brought about the design of a newly perfected aircraft relay by The Allied Control Co., Fulton street, New York, known as its BJU



Now. . .They call it the Wartime Drive!

In cooperation with the government conservation program, Silverstreak silent chain will hereafter be furnished in a durable "black-out" finish.

★★★

● Excess capacity for day-in and day-out trouble-free service is built into the Link-Belt Silverstreak silent chain drive. It maintains its high initial efficiency throughout a long life with practically no upkeep expense.

Slippage and time out for adjustments as frequently occur with friction belt drives, waste more than power—they waste machine time—and, today machine time is mighty valuable.

The Link-Belt Silverstreak silent chain cannot slip. It delivers every r.p.m. of the motor to the driven machine through tooth-to-tooth contacts—assuring full rated machine output at all times. It is truly the "wartime drive."

Low Annual Cost
Silverstreak silent chain drives are low in first cost (often lower than V-belts), and the most important cost, the total cost per year of efficient service is always less.

Practically No Upkeep
Link-Belt Silverstreak silent chain drives run at full efficiency year after year without attention or maintenance other than periodic oiling.

Can't Slip
Silverstreak silent chain drives cannot slip. The teeth of the chain and the teeth of the sprockets mesh like a gear train—no lost r.p.m.— the rated capacity of the machine is maintained with more uniform production.

98.2% Maintained Efficiency
Silverstreak silent chain drives maintain their 98.2% efficiency throughout their life . . . are not affected by periods of idleness or atmospheric conditions.

Easy to Install
Silverstreak silent chain can be installed quickly and easily, without dismantling bearings or parts of the machine. To install, slip the chain over the wheels, insert and secure the pin.

Continuous Uninterrupted Service
Link-Belt Silverstreak silent chain drives need no frequent adjustments as are required to maintain belt tension. They are trouble-free, dependable.

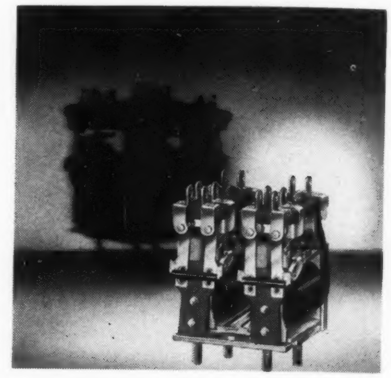
Unaffected by Temperature
There is no difference in the performance of Link-Belt Silverstreak silent chain drives when the atmosphere is hot, cold, dry or damp. Neither do they deteriorate as do leather and rubber when not in use or when exposed to oil or moisture.

Long Lived
20 years of efficient service not unusual. Silverstreak silent chain drives have continuous record performances of 10, 15, 20 years and over, with practically no attention or upkeep. Unlike belts, they are run slack eliminating excessive friction and wear and absorbing shocks.

LINK-BELT COMPANY
Indianapolis, Ewart Plant, 220 S. Belmont Ave.
Chicago · Philadelphia · Atlanta · Dallas · San Francisco · Toronto
8902-B
Branch offices, warehouses and distributors in principal cities
Leading Manufacturer of Mechanical Transmission Equipment—Silent and Roller Chains .. Speed Reducers .. Speed Variators .. Roller, Ball and Babbitted Bearings .. Collars .. Couplings .. Base Plates .. Take-Ups .. Clutches .. Gears .. Sprockets .. Hangers .. Shafting .. Pulleys, etc.

LINK-BELT Silverstreak SILENT CHAIN DRIVES

type. This relay locks mechanically in either position so that only momentary current needs to be applied to the coils. Of four-pole double-throw type, the relay has a



maximum rating of 5 amperes per contact, is noninductive and is available for alternating or direct current operation. Weight is 7 ounces and size 1-13/16 x 1-5/16 x 2 inches. The relays meet every Army, Navy or CAA specifications.

Direct-Cranking Electric Starters

DIRECT-CRANKING electric starters have been added to the line of Champion Aviation Products Co., Los Angeles. Having the highest power for its size of any equipment of this type, the starters are designed for aircraft engines up to 400 horsepower, tanks, landing barges and cargo freight liners. Model No. 1200 is for small airplane engines and weighs 18 pounds; No. 1300, weighing less than 20 pounds, is used to crank some 400-horsepower engines. An improved safety clutch for which patents are pending is used in the starters. Positive action is transmitted to the crankshaft through multiple gear reductions and driving jaw. Either 4 or 5-inch standard mounting is supplied. Model No. 1300 starter is 9¼ inches long overall, 5¾ inches wide and 7 inches deep.

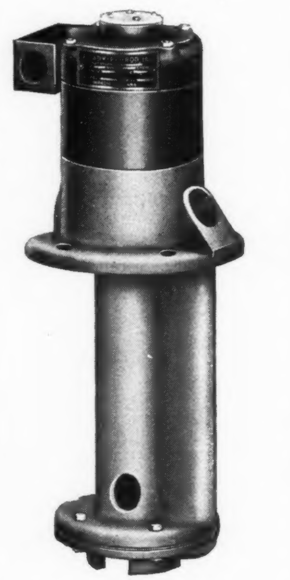
Babbitt Metals Have New Base

IN SPITE of tin shortage, a new base for babbitt metals which ordinarily contained approximately 90 per cent tin has been developed by National Bearing Metals Corp., 4930 Manchester avenue, St. Louis. The new "Rex" material to be used for bearing linings is the result of—and comes within—the Government's order limiting tin content to 12 per cent. There is only a minimum sacrifice in tensile and compressive strengths; otherwise the material compares favorably with other former high tin base bab-

bitts. Characteristics of the new material are: Tensile strength, 8200 pounds per square inch; per cent of elongation in 2 inches, 1.2; reduction in area, 1.8 per cent; compressive strength, 17,500 pounds per square inch; specific gravity, 9.6; brinell hardness, 25; pouring temperature, 625-675 degrees Fahr. Rex may be used as a substitute for high tin base babbitts for most present uses, if lining is properly applied and bearings are carefully fitted and lubricated.

Coolant Pump Is Adaptable

AN ADAPTABLE coolant pump is being marketed by Brady-Penrod Inc., 1212 West Second street, Muncie, Ind. Known as Model 7500, the pump may readily be made an integral part of any grinder, lathe, cutting or drilling machine. A plate adapter enables the pump to fit any tank or base opening. Available in three different depths from flange of 4⅞ inches, 9 inches and 15 inches, the pump can also be made in special depths. Its motor capacity is ⅛ to 1½ horsepower. Suitable for use with abrasives, the controlled flow of any standard coolant fluid is from 4 to 100 gallons per minute. Internal piping of the pump is eliminated and external piping is reduced to a minimum. Pump is motor-driven open-impeller centrifugal type, submergible, with an outside discharge. It is simple and is easy to install. All internal piping is eliminated and external piping is reduced to a minimum on this model coolant pump. The company also has six other pumps which like this coolant pump deliver as high as 70 per cent hydraulic efficiency by actual test.



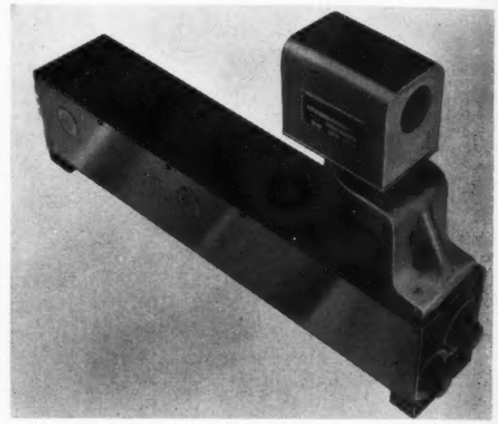
Wood-Base Thermoplastic

FOR use as pulleys, rollers, pushbuttons, etc., a new wood-base thermoplastic known as Densewood is being marketed by Densewood Corp., Elkhorn, Wis. Furnished in rods or tubes to be machined into parts, the material is impact resistant, has a tensile strength of 18,000 pounds per square inch, a high dielectric strength, takes high polish, and has low moisture absorption. It is heat resistant to 350 degrees Fahr., and its flexibility is low. Nonflammable and opaque, the material has a specific gravity of 1.15.

Photoelectric Scanner Offered

KNOWN as the dual scanner registration control model B-16, the new scanner developed by United Cinephone Corp., Torrington, Conn., is a complete and flexible photoelectric registration control. One unit houses the complete control, from light source through the scan-

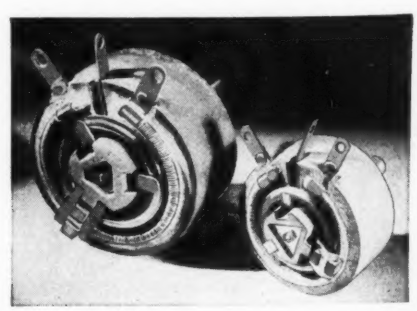
ner and amplifier, to the output connections from the self-contained relay. All external wiring is reduced to one cable. Operated by either transmitted or reflected light or both, this model may be used with transparent, semiopaque or opaque materials. Operation is determined by a three-position selector switch, and is initiated by varying intensity of phototube illumination. Change in phototube illumination caused by passage of mark



through scanner produces change in current which when impressed upon amplifier operates relay, causing action of a direct control device. Contacts also are provided for external connection to a limit switch actuated by a cam or other mechanical means to reset control following each cycle. While designed specially for the packaging field, the Model B-16 is adaptable for use with a wide variety of materials—that is, wherever a material is fed to a machine in a continuous sheet or strip, and is transparent, semiopaque or opaque.

Increase Rheostat Wattage

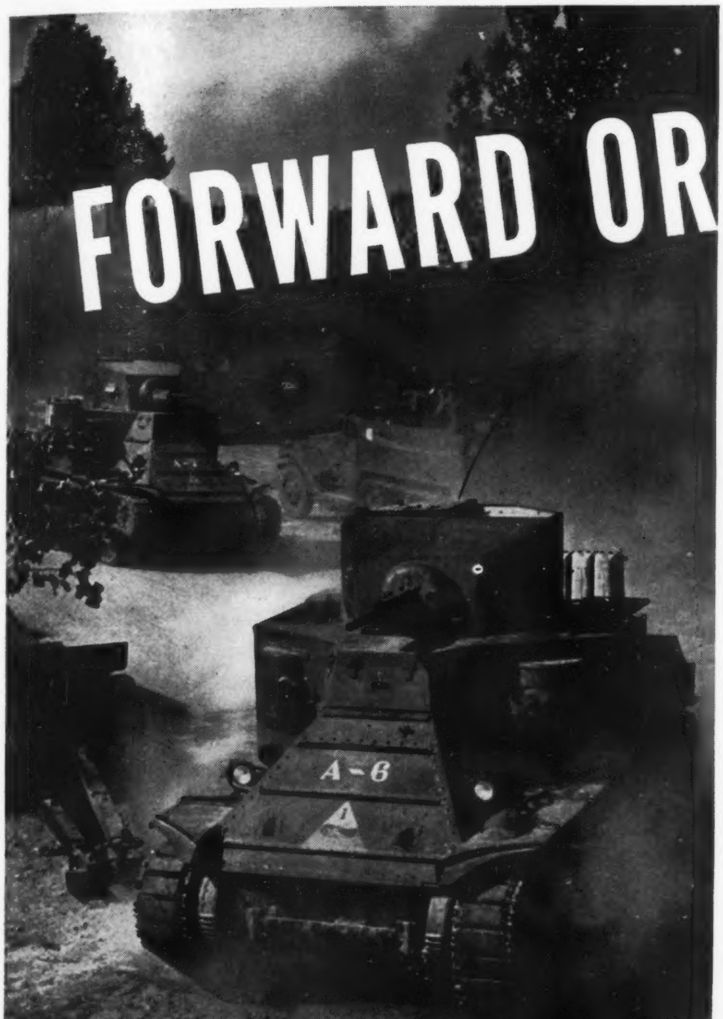
BY ENLARGING features of its 25-watt power rheostat, Clarostat Mfg. Co. Inc., 285-7 North Sixth street, Brooklyn, has developed a 50-watt unit. Virtually identical, except for size, the selected resistance wire is wound on an



insulated metal core which distributes heat at intermediate rotating settings. Resistance element is firmly imbedded in a ceramic housing. Assuring two positive sliding contacts, a graphited-copper contact shoe rides the collector ring and the winding. Contact pressure is provided by a helical spring, concentrically mounted about the shaft, the action of which is distributed evenly by use of a tripod-

(Continued on Page 238)

FORWARD OR REVERSE



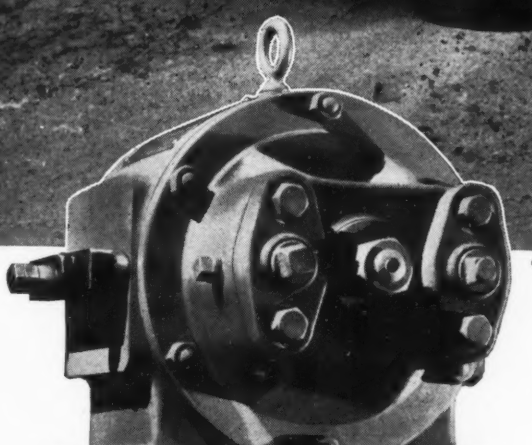
Official U. S. Army Signal Corps Photograph

IT'S A CINCH IN A TANK!

Hele-Shaw Fluid Power also simplifies reversing. Takes jars and jerks out of machines.

Are you designing, building, or operating a machine using a motion that must be reversed? If you can do the job hydraulically and you want to make the reversal smooth as silk, figure on the possibility of using Hele-Shaw Fluid Power.

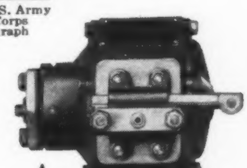
Hele-Shaw Fluid Power is generated in a Hele-Shaw Pump. The pump develops high pressure in an oil medium. Rotary, radial, multiple cylinders smooth out the pulse of the oil. Several types of Hele-Shaw controls are available which reverse the direction of the flow of oil instantly at the pump. With a Hele-Shaw Pump and a Hele-Shaw Control a face grinder manufacturer has eliminated reversing valves, taken the jerks and jars out of his table drive. Our catalog tells many more advantages of Fluid Power. Let us send you a copy.



THE

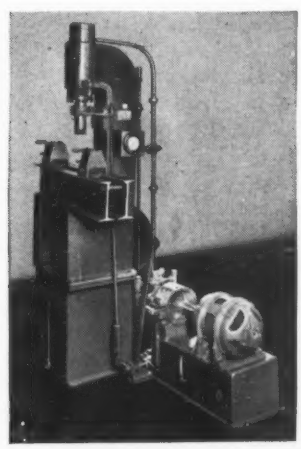
Hele-Shaw

Fluid Power Pump



↑ Hele-Shaw Pump with Type D Regulator—This, one of many Hele-Shaw regulators, reverses the direction of flow, gives any rate of discharge from zero to maximum in either direction independently of pressure.

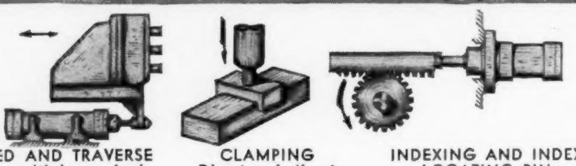
20-TON RIFLE BARREL STRAIGHTENER, manufactured by the Watson-Stillman Company. Operated by a Hele-Shaw Pump equipped with a Type D Control. →

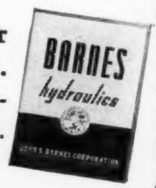


OTHER A-E-CO PRODUCTS: TAYLOR STOKERS, MARINE DECK AUXILIARIES, LO-HED HOISTS

AMERICAN ENGINEERING COMPANY

2502 ARAMINGO AVENUE • PHILADELPHIA, PA.



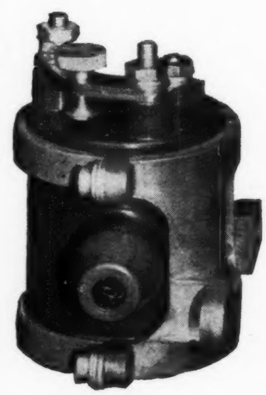


(*Continued from Page* 232)

type contact carrier. Contact is insulated from metal shaft by a center ceramic insulator, providing a "dead" shaft and mounting bushing. The rheostat is available in any resistance value to and including 10,000 ohms.

Booster Coils for Aircraft Engines

FOR aircraft engines two newly designed ignition booster coils have been introduced by General Electric Co., Schenectady, N. Y.—one for use on 12-volt circuits and the other for 24-volt circuits. Complying with U. S. Army Air Force specifications, the booster coil provides ample and positive spark for starting aircraft engines at low magnetic speeds. The booster operates only at starting and is then cut out of the ignition circuit. One booster coil per magneto is required. Constructed of a specially developed material the housing provides extra insulating strength and high resistance to arc cover. The booster coil operates under wide range of ambient temperature. These rate from—70 degrees Fahr. to 200 degrees Fahr.



Flame-Resistant Varnish

DEVELOPED by The Sterling Varnish Co., 146 Ohio River boulevard, Haysville, Pa., a new flame-resistant insulating varnish, designated as R-878, is recommended for class B high-temperature insulation. Mechanically strong, the varnish dries all the way through when applied to electrical apparatus. It will not support combustion, when flame is removed, neither will it melt nor resoften under operating temperatures. The varnish has good heat-resisting qualities.

Timers Are Vernier-Set

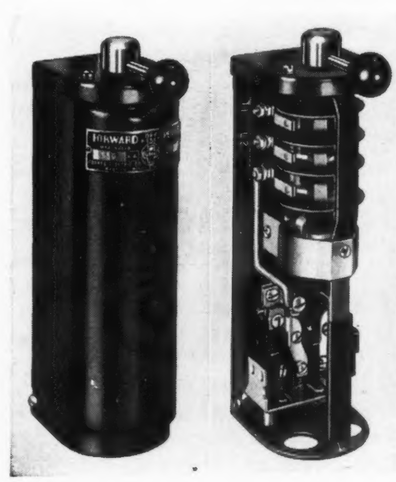
FOR controlling machine and process operations in such varied applications as molding presses, automatic quenching, die casting machines, automatic lubrication, automatic weighing, alarms and signals, etc., a new Series 2800 "Vernier-Set" timer has been produced by Automatic Control Co. Inc., 34 East Logan street, Philadelphia. Standard built-in motor, simple knob-setting without locking device, use of vernier scale for micro settings, ⅜-inch fine silver contacts, and hand adjustments to slides and bridges for changing operating functions are features. These are augmented by a one-piece molded bakelite terminal block, accommodating external wiring to clearly marked screw post terminals, as well as to bridge positions for easy selection of desired arrangement. A leafspring contact is provided for positive make-break action. Timer and load circuits are wired independently on all types but timer and load circuits can be wired together by simply placing an external jumper across L2 and C terminals. Two

types of timers in this series are available: Normal-clutch-action for resetting upon power failure; and reverse-clutch-action for nonresetting on power failure. Various sheet metal housings for surface or flush-mounting, as well as

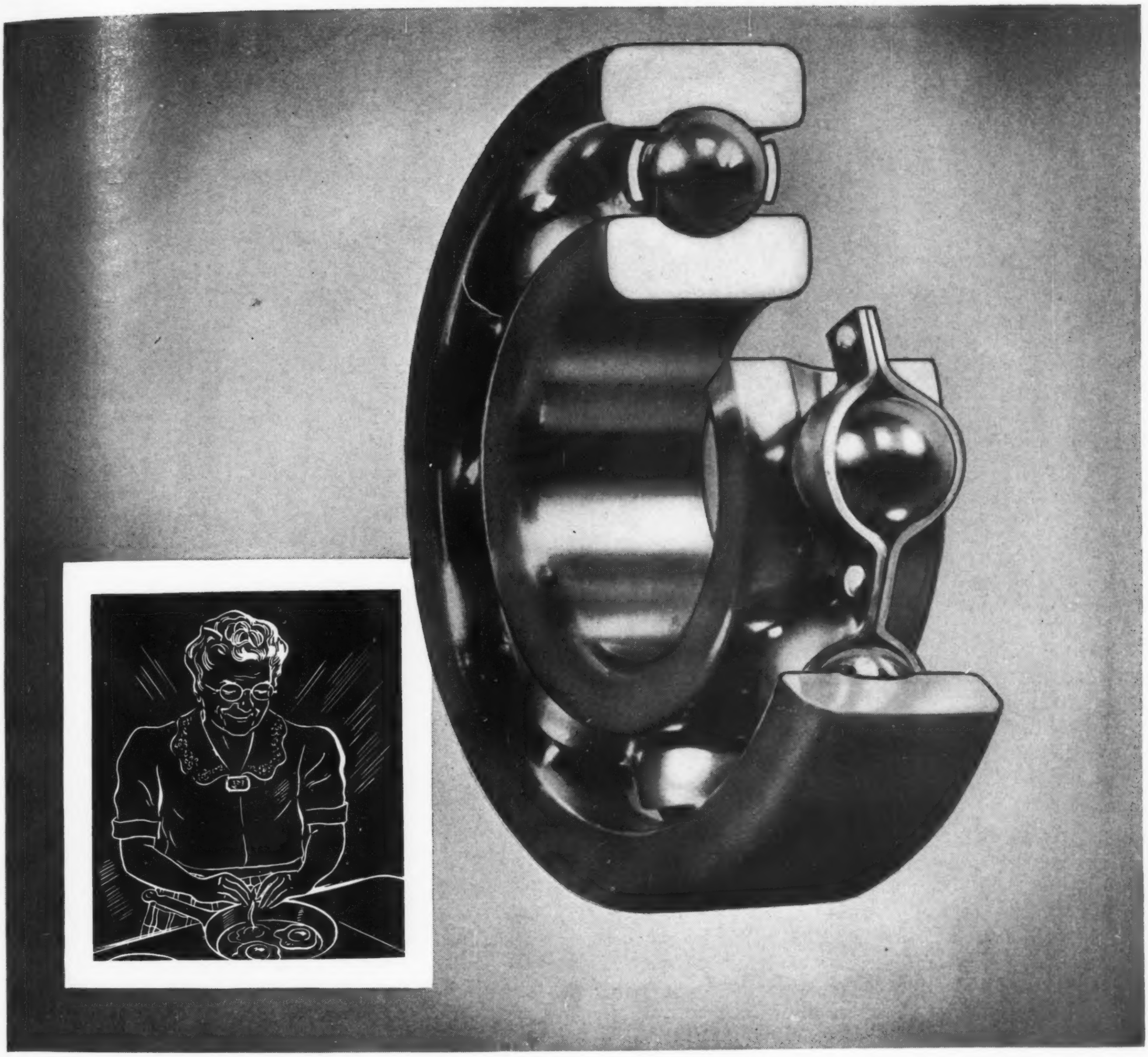
cast iron explosionproof cases for one or two units are available. Standard units may operate from 110 to 220 volts, 25, 50 or 60 cycles. Load contacts are rated to carry 25 amperes at 110 volts alternating current, noninductive.

Overload Unit in Controls

REVERSING drum controllers introduced by Furnas Electric Co., 439 McKee street, Batavia, Ill., have a built-in polyphase thermal overload unit. In case of overload in any phase, power is disconnected independently of the reversing part of the controller, and overload is signalled by a red indicator which projects through the top of the controller housing. The overload unit which



is of the solder-pot type and trip-free, cannot be reset and power reconnected until drum handle has been returned to the off position. Type K304 is available in 2 horsepower, 550 volts, alternating current (maximum), and K302 in 5 horsepower, 550 volts, a. c. (max.)



A TIP FROM GRANDMA

On Mounting Ball Bearings!

EVER watch your grandmother fry an egg? Whether you realized it or not, she was giving you a tip or two on the proper mounting of ball bearings! Remember how thoroughly she cleaned her frying pan? How gently she handled the egg in carrying it to the stove . . . *taking care to avoid cracking the shell until the egg was directly over the pan?*

Well . . . one of the first precautions in mounting ball bearings is to clean the housing or shaft that is to receive the bearing as carefully as grandma cleaned the pan that was to receive the egg. Another important point is not to remove the protective wrapper *until you have carried the bearing to the shaft* . . . just as grandma carried the egg from the refrigerator to the frying pan before she cracked the shell.

Here's another tip. Consult page 8 of your BCA Data Book before mounting. Instructions given there will help you to grind the Axis . . . instead of your bearings!

BEARINGS COMPANY OF AMERICA, LANCASTER, PENNA.

BCA

RADIAL • ANGULAR CONTACT • THRUST

BALL BEARINGS

Standardize on Standard Sizes

MEN Of Machines

After serving a little more than two years as staff officer in the offices of the assistant and under secretaries of the United States Navy, Commander R. E. W. Harrison has been released from active duty. He resumes his duties as vice president of Chambersburg Engineering Co., Chambersburg, Pa., and Clarke-Harrison Inc., Philadelphia, and will devote his efforts to the provision of basic tools required in the production of airplanes. While in Washington, he was assigned the task of providing machine tools required at the United States Navy Yards, naval bases and other establishments. Before being connected with the Navy he was, as mentioned above, vice president of the Chambersburg and Clarke companies, and prior to this was head of the machinery division of the bureau of foreign and domestic commerce, Washington.

♦

Bert Dingley, executive vice president, Marmon-Herrington Co. Inc., Indianapolis, has been elected president. R. C. Wallace now becomes vice president in charge of engineering.

♦

Thomas D. Jolly, chief engineer of Aluminum Co. of America, has been elected vice president of the company.

♦

Charles F. Kettering, vice president of General Motors Corp., has been appointed as consultant to the Radio Branch of the War Production Board.

♦

Glendon H. Armstrong has been made head of a special research department formed to work exclusively on research as part of International Business Machine

Corp.'s planning to meet war demands. Mr. Armstrong was previously manager of engineering at the Endicott, N. Y. plant.

♦

T. L. Kishbaugh has accepted an appointment as a dollar-a-year man with the War Production board, Washington, to serve in an advisory capacity as an alloy steel specialist. Mr. Kishbaugh was vice president of Earle M. Jorgensen Co., Los Angeles.

♦

John C. Enblom of the engineering department of Donaldson Co., Inc., has been made first vice president.

♦

An appointment which will be of interest to automotive engineers and those connected with the design and manufacture of internal combustion engines is that of Bruno Loeffler who has recently been made chief engineer of the American Bosch Corp., Springfield, Mass. Mr. Loeffler is widely known in automotive engineering circles, formerly having been associated with Mack Trucks for twenty years. During the past fourteen years of this period he held the position of chief design engineer of the engine division. The experience Mr. Loeffler has gained with both gasoline and diesel engines and their accessories will prove particularly valuable in his new connection.

♦

Otto L. Beiswenger succeeds Henry G. Schmidt as manager of the engineering staff of Goodyear Tire & Rubber Co.

♦

Leonard J. Wahler, formerly assistant chief engineer, Western Foundry Co., Chicago, has been made chief engineer, succeeding E. J. Brady, resigned. Before becoming connected with this company, Mr. Wahler was associated for twenty years with the former Stover Mfg. & Engine Co.

♦

J. M. Berkenstock has recently been elected president of the National Association of Fan Manufacturers.

♦

Roy M. Smith has joined Roller-Smith Co., Bethlehem, Pa., as assistant chief engineer. Formerly he was engineering manager for the wiring device division of Bryant

Electric Co., and previous to this was connected with Westinghouse Electric & Mfg. Co., as section engineer on relay design and application.

♦

Dr. Charles Byron Jollife has been made vice president and chief engineer of RCA Mfg. Co., Camden, N. J. He formerly was assistant to the president of Radio Corp. of America and chief engineer of the RCA Laboratories.

♦

Philip F. Smith, secretary of The Osborn Mfg. Co., has been appointed senior priority specialist in the Special Industrial Machinery branch of the War Production board.

♦

As director of engineering of Fostoria Pressed Steel Corp., Fostoria, Ohio, Willard S. Crandall succeeds Lieut. Ray N. Green who resigned to join the armed forces last fall. Mr. Crandall has been with the Fostoria organization for some time, his first connection being that of western district manager. He later assumed managership of the entire western division for the company, and held that post until early this year when he was placed in charge of the firm's development activities. His long experience with Fostoria, from the sales and development ends, will better enable him to fulfill his duties as director of engineering of the company.

♦

R. W. Dinzl has been appointed vice president in charge of engineering, Watson-Stillman Co., Roselle, N. J.

♦

Stephen J. Benn has been named chief engineer of Globe Hoist Co., Pittsburgh. Prior to his appointment as chief engineer, Mr. Benn was mechanical engineer at Brunner Mfg. Co.

♦

George C. Cudhea, a member of the engineering staff of Fleetwings Inc., has been made executive engineer.

♦

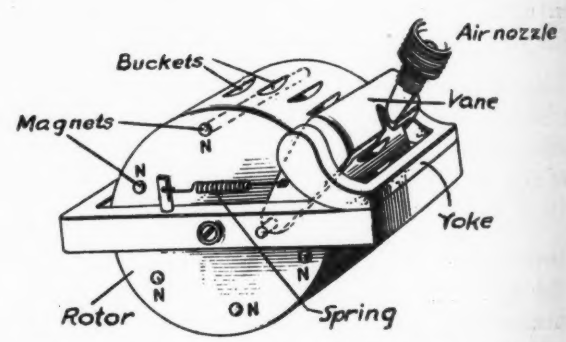
Walter Sutton, formerly the chief engineer at The Lindsay Wire Weaving Co., has become connected with S. K. Wellman Co., manufacturer of friction lining materials. Mr. Sutton, who also is the president of the Cleveland Engineering Society, is a contributor to Machine Design.

Noteworthy PATENTS

Regulates Gyroscope Speed

AIRCRAFT instruments such as rate-of-turn indicators, directional gyroscopes and artificial horizons employ high-speed gyroscopes driven by small air turbines. Air is generally supplied by an engine-driven suction or pressure pump, by using the intake manifold suction, or by a venturi tube projecting into the air stream. Pressure variations in the supply line from any of these sources require the use of a governor to keep the gyroscope speed substantially constant. A simple device for so regulating gyroscope speed is the subject of a patent assigned to Bendix Aviation Corp.

Rotor of the gyroscope is mounted in a gimbal frame



Eddy currents in vane create drag force, consequent vane movement cutting off air to buckets in case of temporary overspeed

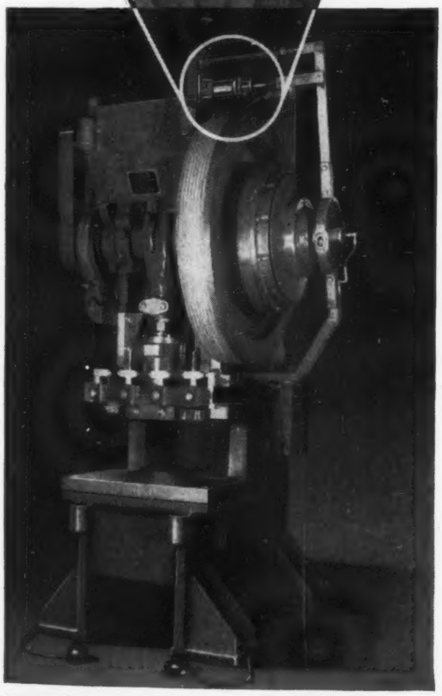
and driven by air pressure from a nozzle impinging on buckets in the periphery of the rotor. Control of the quantity of air reaching the buckets is effected by a tapered notch cut in a metal vane pivoted in the frame and normally held away from the nozzle by a spring. Permanent bar magnets embedded in the rotor periodically pass under the vane, and a magnetic circuit is completed through the vane and through an adjacent yoke which is made of a material having high permeability, such as soft iron. The pivoted vane is copper, aluminum or other good electrical conductor.

Eddy currents are set up in the vane due to the moving field and provide secondary magnetic fields which react with the bar magnet field, causing a drag on the vane which, however, is overcome by the spring tension except when the speed exceeds normal. Increase of speed due to a surge in pressure increases the eddy currents and drag, pulling the vane under the nozzle and reducing the amount of air reaching the buckets. As speed returns to

Hanna Cylinders

Air and Hydraulic

These SKILLED MECHANICS are helping presses operate at top efficiency

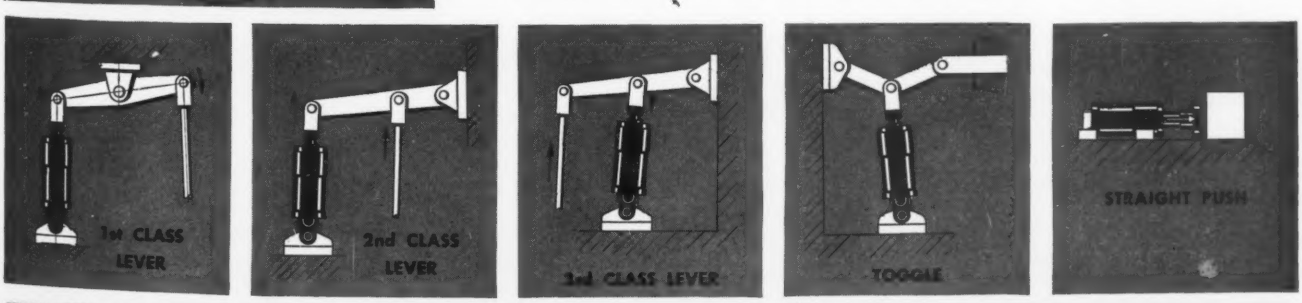


Can you use them?

ALL Verson Presses, like these two units, are built for top performance . . . in productivity, work quality and long life. Smooth-working, dependable Hanna Cylinders are used on many of them to perform varied operations with tireless skill and efficiency. For instance: in the top illustration a Hanna Cylinder is used for removing the finished shell casings after heading on a 1500 ton Verson Steel Knuckle Joint Press. At the left is shown a Verson Steel Single Crank Gap Press with a friction clutch shifted by a Hanna Cylinder. Both are good application examples of versatile, economical, easy-to-use Hanna "Skilled Mechanics" Cylinder Power.

On your equipment or in your plant there must be many places where Hanna Cylinders may be used to advantage: for replacing manual and skilled labor; and to deliver safe, reliable power, direct or through a lever or toggle for jobs needing a pushing, pulling or lifting movement.

The illustrations below point out a few of the fundamental mechanical movements for which Hanna Cylinder Power may be used to advantage. What applications of your own could they be adapted to? *Send for catalog 230.*



HANNA ENGINEERING WORKS
1765 ELSTON AVENUE • CHICAGO, ILLINOIS

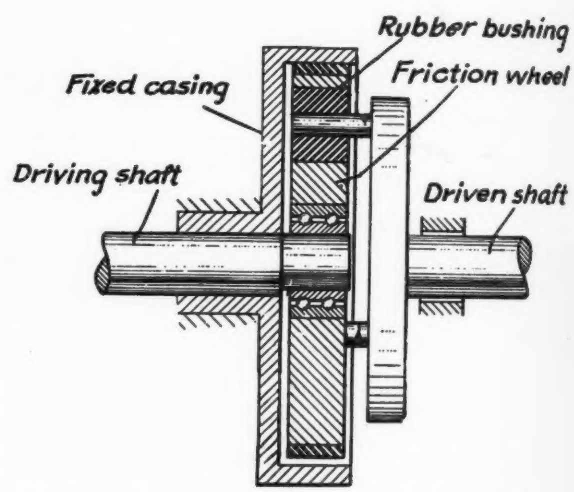
Air and Hydraulic RIVETERS — Air and Hydraulic CYLINDERS — Air HOISTS

normal, the spring pulls back the vane, permitting full impingement once more.

Combines Silence, High Reduction

WHEN used to drive low-speed domestic and other machines, high-speed universal motors require large transmission ratios in the reduction drive. Conventional gear trains with overall speed ratios of 100 to one or more are relatively expensive and apt to be noisy. A silent and inexpensive reduction gear mechanism designed for such purposes is described in a patent assigned to the Westinghouse Electric & Manufacturing Co.

An eccentric on the end of the driving shaft carries a freely mounted friction wheel which rolls on the inside



Friction wheel rolls upon inside of fixed casing, rotating slowly in opposite direction to driving shaft

surface of a cup-shaped fixed casing. Diameter of the wheel is slightly less than that of the casing surface hence with each revolution of the driving shaft the wheel rotates a fraction of a revolution in the opposite direction. A flange on the driven shaft supports three pins which project into rubber bushings located in the friction wheel. The driven shaft therefore rotates with the friction wheel, the slight difference between the circular motion of the pin and the hypocycloidal motion of the bushing being absorbed by the resilience of the bushing material. The greater the speed ratio, the smaller is this difference. For a ratio 100 to one, eccentricity of the friction wheel and driven shaft is about one per cent of the wheel diameter.

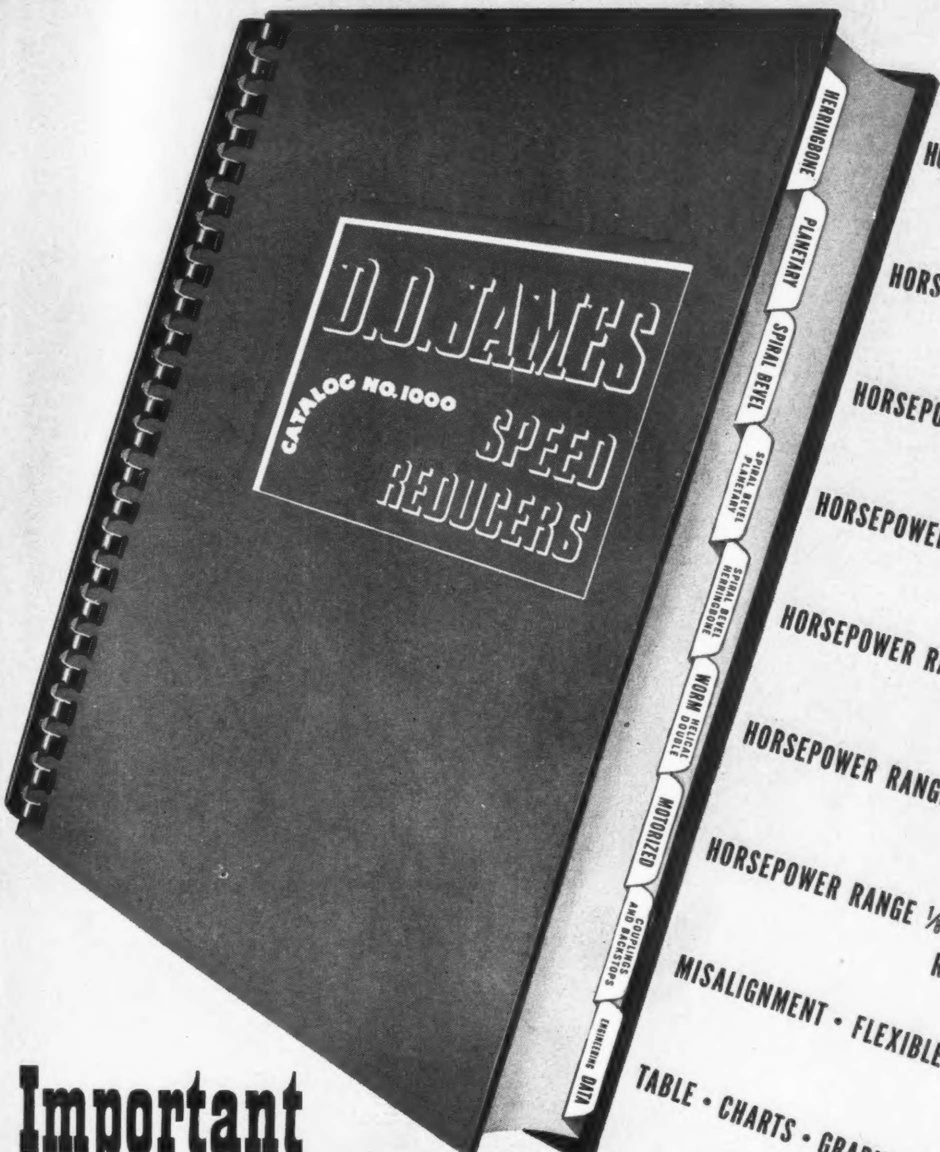
Controls Intermittent Braking

BRAKES employed to stop intermittently-driven mechanisms, or to eliminate play and backlash, absorb power unnecessarily unless made self-acting so that they release at the proper time during the driving part of the cycle. Such a self-acting brake is described in a patent assigned to Mergenthaler Linotype company.

Brake shoe is of the external type, braking force being predetermined by the adjustment of a spring shown at

(*Concluded on Page* 256)

FOR OVER FIFTY YEARS MAKERS OF EVERY TYPE OF GEAR AND GEAR REDUCER



HORSEPOWER RANGE ¾ TO 1200
Ratios 2:1 to 367:1

HORSEPOWER RANGE ¾ TO 75
Ratios 10:1 to 1200:1

HORSEPOWER RANGE ¼ TO 275
Ratios 1:1 to 6:1

HORSEPOWER RANGE ¾ TO 75
Ratios 8:1 to 1200:1

HORSEPOWER RANGE ¾ TO 375
Ratios 6:1 to 44:1

HORSEPOWER RANGE ⅙ TO 150
Ratios 5:1 to 2000:1

HORSEPOWER RANGE ⅙ TO 75
Ratios 1:2 to 1200:1

MISALIGNMENT • FLEXIBLE

TABLE • CHARTS • GRAPHS

Important *Speed Reducer* Information for you...

Send for it on your Letterhead!

■ **This Permanent Record Catalog No. 1000 is now available. It contains 400 pages of Illustrations and Engineering Data, covering application, examples of use, horsepower ratings and dimensions of Every Type of Speed Reducer. It will be a positive aid to your engineering and purchasing departments. May we send you a copy of Catalog 1000.**

D.O. James

MANUFACTURING COMPANY • 1120 W. MONROE ST. • CHICAGO

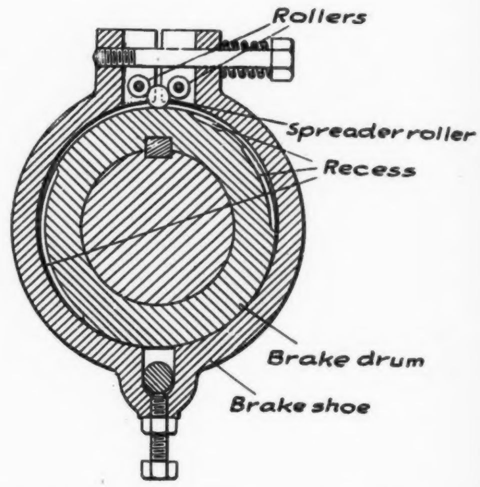
To Eli Whitney goes the credit for development of interchangeable manufacture, first used in the production of firearms. He also exercised his ingenuity in developing a milling machine. To a large extent the construction of this machine was makeshift but basically it embodied many ideas now in use. Today, however, design engineers have at their command an almost unlimited range of standard parts, materials, finishes and accessories. The engineers' greatest problem lies in proper selection, a responsibility MACHINE DESIGN shares by keeping its readers abreast of the latest developments in all phases of design work.

Eli Whitney and his Milling Machine

Tools . . . Tools . . . and more Tools to keep Democracy alive. History will record their importance in the great battle for freedom. Pioneers like Eli Whitney were little aware of the influence they would wield in a great cause. Yet today their contributions to mechanical development are perhaps the most significant factor in our fight to maintain a world in which human rights hold sway over prejudice, power . . . and ultimate enslavement.

(*Concluded from Page* 250)

the top of the figure. A spreader roller, rolling on the surface of the brake drum, normally expands the brake shoe by forcing apart two rollers pivoted in the two ends of the shoe. As the brake drum rotates, the spreader roller periodically drops into one of the partial grooves cut in the periphery of the drum, allowing the spring to



Brake is applied when spreader roller drops into recess in brake drum

engage the brake shoe with the drum. The grooves are located so as to furnish the braking effect at the required periods of the cycle.

Lower end of the brake shoe is mounted on a support fixed to the frame and so adjusted that the shoe does not drag the drum when the brake is disengaged.

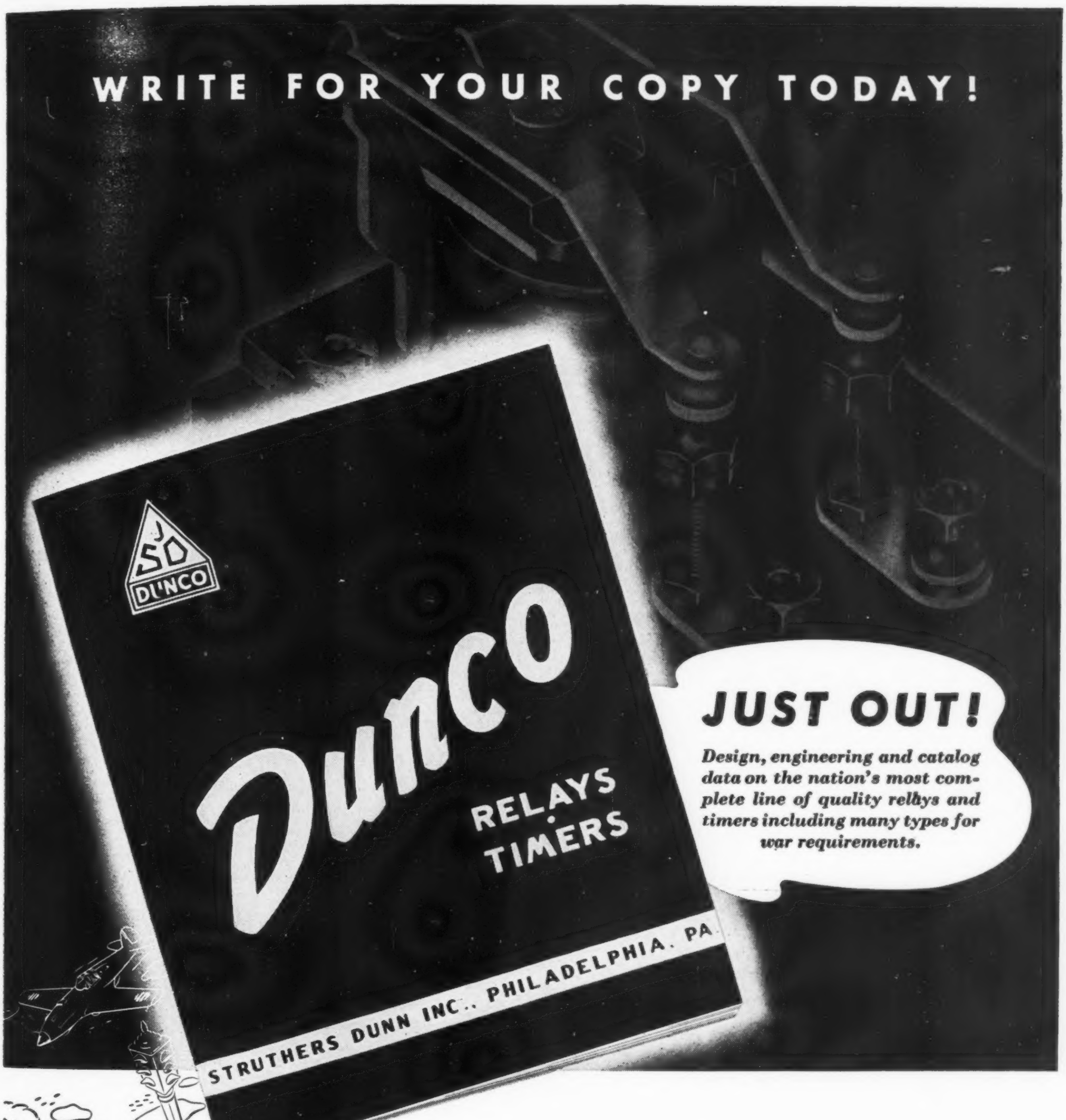
A.S.M. To Honor Garand

INVENTOR of the semiautomatic rifle which bears his name, John C. Garand will receive a special award from the American Society for Metals at its annual dinner in Cleveland, Thursday evening, October 15.

When, after intensive efforts to develop a rifle combining simplicity, strength and lightness, the inventor finally produced the Garand, experts hailed it as the greatest advance in infantry arms in 25 years and "the best high-speed firearm on earth". Weighing nine and one-quarter pounds, it is .30 caliber and uses a clip of eight cartridges. Pressure of the discharge is utilized to eject the spent shell and to place a new one in place for firing. Since it will fire as fast as the trigger is pressed, a good rifleman can shoot forty rounds per minute.

Garand has received many honors in addition to this new one in store for him at the National Metal Congress. During the Philippine campaign, General MacArthur cabled that much of his army's success was due to "the fine performance, durability and fire power of the Garand rifle".

A model of the rifle, standard equipment today for both the Army and the Marine Corps, will be displayed in the War Conference section of the National Metal Exposition at Cleveland public auditorium, October 12-16.



THE NEW DUNCO CATALOG AND RELAY-TIMER DATA BOOK

• Far more than a catalog, the new Dunco Relay-Timer Book is a complete guide to relay selection and usage. Fully revised, greatly enlarged, profusely illustrated, replete with detailed specifications and engineering information, and prepared with a particular eye to war equipment requirements, it is a book that should prove helpful to designers, engineers, purchasing agents, production executives and maintenance men alike.

Write for your copy today—or as many copies as may be required to equip your organization. Please mention company connection.

STRUTHERS DUNN, INC., 1341 CHERRY STREET, PHILADELPHIA, PA.

ASSETS to a BOOKCASE

Metallurgy

By Carl G. Johnson, Assistant Professor of Mechanical Engineering, Worcester Polytechnic Institute; published by the American Technical Society, Chicago; 262 pages, 5½ by 8¼ inches, clothbound; available through MACHINE DESIGN, $2.50 *postpaid.*

With the currently extending use of low alloy steels and modified nonferrous metals, the designer is more than ever obliged to keep abreast of the growing fund of information on alloying materials and the effects of heat treatment and working. This enlarged and revised edition of a successful textbook will therefore be welcome for its succinct presentation.

While by no means exhaustive in its treatment of any one phase of the subject, the book gives in concise form the essential information on physical metallurgy that a designer is likely to want. Chemical metallurgy is discussed only to the extent that a knowledge of production methods is necessary to an understanding of the properties of the materials. Included are chapters covering properties of metals and tests to determine their uses, physical metallurgy, commercially important nonferrous alloys, heat treatment of steel, surface treatments, alloy steels, and powder metallurgy.

No previous knowledge of the subject is required by the reader, and for those needing more specific information on particular aspects of metallurgy a list of references appears at the end of the book.

□ □ □

The Electron Microscope

By E. F. Burton, University of Toronto, and W. H. Kohl, Rogers Radio Tubes Ltd.; published by Reinhold Publishing Corp., New York; 233 pages, 6 by 9 inches, clothbound; available through MACHINE DESIGN, $3.85 *postpaid.*

Recent achievements with the electron microscope in revealing minute particles such as the influenza virus have raised the hopes of engineers that parallel developments may be forthcoming in the examination of metallic structures.

In this book, which is written in popular style but from a sound scientific standpoint, the electron microscope is introduced by way of a comprehensive account of physical optics and the light microscope. Principles of the electron microscope are then developed along parallel lines, "light" becoming "electron beam" and "lens" becoming "magnetic lens."

Discussion of optical microscopes ignores the vertical illuminator so essential to the present-day metallurgist. However, electron microscopes for metallographic examination may need no counterpart to the vertical illuminator. Metallic structures have been examined by using the heated surface of the metal itself, coated with a thin film

of barium, as an electron emitter. By this means the crystalline changes in iron at critical temperatures have been observed. With this technique and other recent developments such as the use of thin plastic films .000002-inch thick deposited on etched surfaces and subsequently peeled off for examination, the electron microscope is becoming a powerful tool in the hands of the metallurgist.

The book is illustrated with a representative collection of photographs at high magnification—including one of polymerized vinylchloride enlarged to 210,000 diameters. Discussions of the physical principles underlying both types of microscopes are considerably enlivened by the unique diagrammatic sketches.

□ □ □

Plastics

By J. H. DuBois, General Electric company; published by the American Technical Society, Chicago; 295 pages, 5½ by 8¼ inches, clothbound; available through Machine Design, $3.00 *postpaid.*

Purpose of this book is to provide in one convenient place a broad but detailed summary of the entire plastics industry, containing enough information to enable the user of plastics to choose intelligently the material which will fill his needs. Following a general introduction to the subject, the author takes up the various types of materials separately, indicating their sources, manufacturing processes, properties, and applications. The list is comprehensive and includes phenolics, ureas, cellulose, acrylic vinyl and styrene, cast phenolic and protein plastics, mycalex, nylon, lignin, resin-bonded plywood, the synthetic rubber-like materials, cold-molded and shellac plastics, and laminated plastics.

A subsequent chapter reviews the properties of the various types of materials, giving specific aid in the selection of material for a particular job. The fundamentals of molding and finishing and the design of molded parts are tersely presented in other chapters. Throughout the book quick reference is aided by the liberal use of boldface subheads and the logical arrangement of material. Addition of a table of contents, though of minor importance, would be a desirable feature in later editions.

Designing for Fatigue Stresses

(*Continued from Page* 80)

member are known and the designer would like to know what the value of the equivalent simple stress is for the operating loads present. In this case the values of R_2 and R_3 are known and from *Fig.* 14 the value of R_1 is selected for the known value of the fatigue factor F. With $R_1 = S_b'/S_w$ known, the value of the equivalent working stress S_w is calculated. In this way a more rational estimate is made of the factor of safety present in a particular design.

Procedure for determining the cross-sectional dimensions

of straight members subject to combined bending and torsional moments is discussed in the following:

The members used to illustrate this procedure are of circular, elliptical, square and rectangular cross section, as shown in the accompanying table. For each case the bending moment will be assumed acting about the axis $z—z$. For the elliptical and rectangular sections the bending axis $z—z$ is the major axis. Under these conditions the critical element can be selected by inspection as the element on the outer fiber. The stress values at the outer fiber for each of the cross sections have been given in Part I of this paper. By using these stress values in Equation 4, the required section modulus can be determined. To do this, R_2 is taken to be 0 in Equation 4. Then

$$S_b' = \frac{FS_w}{\sqrt{1+3\left(\frac{S_s'}{S_b'}\right)^2}} \qquad (e)$$

If M' is the maximum bending moment and I is the moment of inertia about axis $z—z$,

$$S_b' = \frac{M'c}{I} \qquad (f)$$

From Equations e and f,

$$\frac{I}{c} = \frac{M'}{S_w F}\sqrt{1+3R_3^2} \qquad (5)$$

Values of the stress ratios R_3 depend upon the particular cross section. For the four sections considered, values of R_3 are given in the table as well as the expressions for the section modulus I/c for each cross section, based on Equation 5. The variation in the section modulus values for various load ratios (T'/M') is shown in *Figs.* 15 and 16. *Fig.* 15 represents the section modulus values for circular and elliptical cross sections while *Fig.* 16 is for square and rectangular cross sections. The equations for determining the section modulus are given in the last column of the table. In these equations T' represents the maximum torque value. To select values of the section modulus from the design charts given, the fatigue factor F must first be determined from *Fig.* 13.

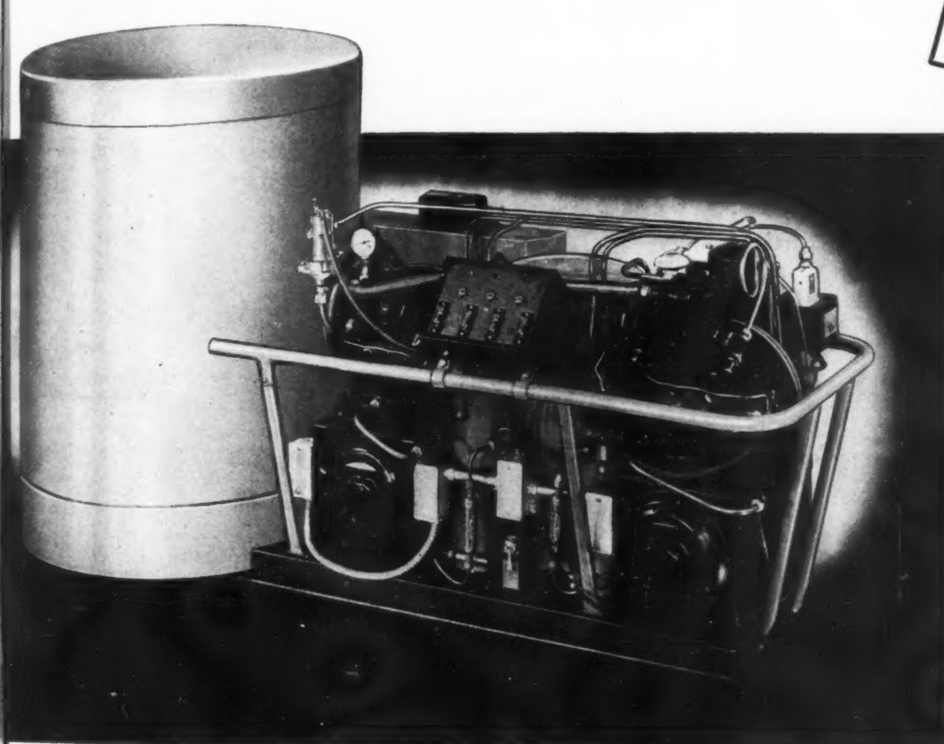
If the critical element cannot be selected by inspection it will be necessary to consider the stress S_w as the equivalent simple stress in Equation 2. The values of the stresses S_a', S_b' and S_s' can then be replaced by their magnitudes in terms of the loads, dimensions and coordinates of the point locating the position of the element. The critical element will be the element for which S_w is a maximum. This maximum can be determined by calculating all possible values of S_w or by using calculus to find the maximum S_w value.

In the design of machine members in which there is a stress concentration, the designer should provide for this condition either by modifying the magnitudes of the design loads or the working stress value.

AUTOMOTIVE industry employment is over 800,000 but is less than 60 per cent of its anticipated peak for war production, according to WPB figures for June recently released.

Deepfreeze *Metal Chilling* serves you three different ways... effects savings up to $2825 per year over dry ice... removes 1000 B. T. U.'s per hour at —120° F.

SEE HOW IT'S DONE AT THE METAL SHOW
Visit our booth at the National Metal Exposition at Cleveland, October 12 through 16. Consult with our engineers—find how Deepfreeze can serve you in your present and future work.



THE DEEPFREEZE SANTOCEL CASCADE INDUSTRIAL CHILLING UNIT has a chilling chamber 24″ in diameter x 30″ deep—over 31 square feet of primary freezing surface. It is equipped with two motors and two compressors of the open silent-valve head, water-cooled, piston type. It has a heat absorbing capacity equivalent to 5¾ lbs. of dry ice per hour at same temperature and under similar operating conditions.

The same standard unit can be furnished 60″ deep, or deeper.

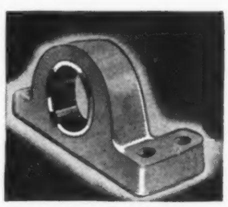
Special units can be furnished to suit specific applications. For instance:

A prominent aircraft manufacturer has been furnished with a special Deepfreeze Unit capable of producing a vacuum condition similar to that found at maximum flying altitude. It is provided with a transparent top and is used for testing flying instruments.

Another aircraft producer has been supplied with an extra deep unit for shrinking landing gear parts in assembly.

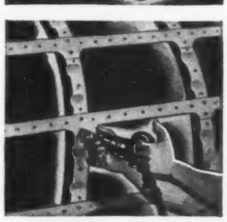
A blood plasma manufacturer uses a special Deepfreeze Unit for desiccating blood plasma. These are but a few of the many applications of Deepfreeze. It will serve you as well.

Metal working industries' newest helper—the Deepfreeze Cascade Industrial Unit is saving time and money in practically every type of metal working plant in the country. It can also serve you in any one, or all three, of the following ways:



1 Shrinking of metal at *−100° F. to −120° F.* has made it possible to assemble bearings and similar parts requiring a press-fit, by merely slipping them into position...eliminates spoilage caused by "pounding" bearings into place...saves time caused by delay in replacing bearings...saves cost of expensive equipment.

Another application is in chilling aluminum alloy rivets 17S-T and 24S-T to retard aging. Rivets can be kept soft enough for driving for a period of over two weeks.



2 Testing of metals at *−100° F. to −120° F.* has made it possible to study the reactions of aircraft instruments to stratosphere flying. Aircraft engine lubricants can also be pretested for sub-zero flying. Tests are usually conducted over a 6 or 8 hour freezing period.

3 Treating of metal at *−100° F. to −120° F.* will produce combinations of hardness, strength and ductility not obtainable by ordinary hardening or tempering. For treatment of high-speed steel, temperatures colder than −150° F. are ineffective. Temperatures *warmer* than −100° F. are also ineffective. The Deepfreeze Cascade Unit is capable of maintaining −120° F., making it ideal for the proper treatment of high-speed steel.

$2825 SAVINGS OVER DRY ICE!

Laboratory tests prove that the cost for removing 1000 B.t.u.'s per 24-hour day over a period of one year with dry ice will cost $3000.00, as against the $175.00 electric current consumption of the Deepfreeze over the same period of time.

DEEPFREEZE DIVISION
MOTOR PRODUCTS CORPORATION
2329 DAVIS ST., NORTH CHICAGO, ILLINOIS

FREE ADDITIONAL INFORMATION

and proof of the outstanding success of the Deepfreeze method for chilling metals is included in this booklet. Write for your copy today. Address...

DEEPFREEZE DIVISION, MOTOR PRODUCTS CORPORATION
2329 DAVIS ST.
NORTH CHICAGO, ILLINOIS

Name ______ *Title* ______

Company ______

Address ______

Business and Sales Briefs

FOR the past several years in the sales organization of Kropp Forge Co., Chicago, J. H. Lund has been named vice president of Kropp Forge Aviation Co., a subsidiary.

♦

R. F. Ohmer recently resigned as president of New Wrinkle Inc., Dayton, O., to report for duty as a colonel in the U. S. Army Air Forces. During his absence, New Wrinkle is under the direction of J. C. McCorkhill, general manager.

♦

Associated with B. F. Goodrich Co., Akron, since 1928, J. T. Callahan is now western district manager of the company's national sales and service division, with headquarters in Chicago.

♦

Opening of two new branch offices to serve war material producers better has been announced by Square D Co., Detroit. C. T. Nash, formerly with the company's New York office, will be in charge of the new office at 146 Chestnut street, Springfield, Mass. W. W. Hendrickson has been transferred from the Charlotte office to open a new office in Greensboro, N. C., located at 303 Kensington road.

♦

Connected with General Electric Co., Schenectady, N. Y., since 1928, W. R. King has been placed in charge of all activities for the promotion and sale of motors, controls and other electric apparatus to the machine tool industry.

♦

Well known in the power transmission field, Irwin A. Marshall has been added to the contact engineering staff of Foote Bros. Gear & Machine Corp. He will represent the company in Cleveland and Northern Ohio territory.

♦

Ohmite Mfg. Co., Chicago, has made another large expansion in factory space and production facilities—this in addition to the big increase in plant size announced a short time ago.

♦

George Frutchey has been named Chicago representative for Lord Mfg. Co., Erie, Pa., with offices at 52 North Michigan avenue, Chicago. Mr. Frutchey replaces George P. Harrington who is now in the Navy.

♦

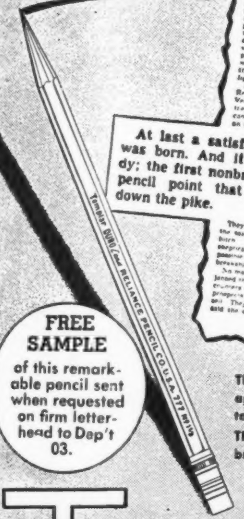
Consolidation of the Moraine Products and Delco Brake divisions in Dayton, O., has been affected and the new organization will be known as Moraine Products division. It will be under the direction of Bernard A. Brown as general manager. Mr. Brown was general manager of Del-

Thanks —
DALE CARNEGIE
Ex-Pencil Point Busters Everywhere Agree It's Almost UNBREAKABLE

HERALD Express
Editorial Page of the
Dale Carnegie
Philosophy Of Life

So he went to a "weight engineer" and told him to work out a way that people could see with their own eyes how tough the lead pencil point was.

At last a satisfactory pencil was born. And it was a dandy; the first nonbreakable lead pencil point that ever came down the pike.



FREE SAMPLE
of this remarkable pencil sent when requested on firm letterhead to Dep't 03.

This dramatic endorsement of TEMPLAR DuroLead appeared in 72 important newspapers from coast to coast.

TEMPLAR DuroLead users are never interrupted by broken pencil points. They finish what they start.

RELIANCE PENCIL CORP.
MT. VERNON • NEW YORK

Templar DURO *Lead*
U. S. Patent 2,131,657
The almost **UNBREAKABLE** *pencil*

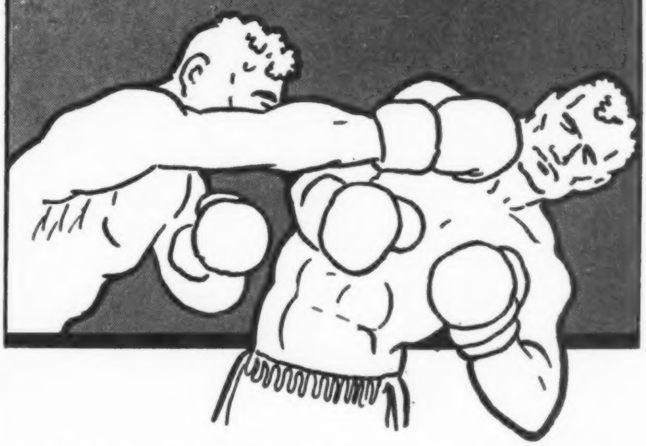
LONG-LIVED RELIABLE PUMPS
—to help your machines operate on round-the-clock service

Geared - Vane - Centrifugal — a wide range of sizes for various applications.

B·S Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

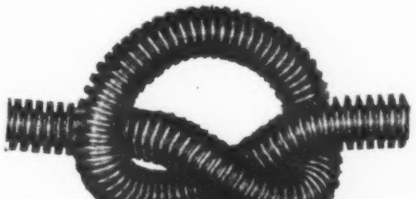
BROWN & SHARPE PUMPS

BENDING
WITHOUT
BREAKING
IS THE SAME AS "ROLLING WITH THE PUNCHES"



and that is the performance given by

ECLIPSE AVIATION
SEAMLESS FLEXIBLE METAL HOSE
FOR MACHINERY



Write for Free Bulletin H-201

THE INVISIBLE CREW
Precision Equipment by Bendix
AVIATION CORPORATION

PHILADELPHIA DIVISION
4709 Wissahickon Ave. Philadelphia, Pa.

co Brake. Earl S. Patch, active in the development of the powder metal products of Moraine, will continue with similar responsibilities in the new division.

♦

Connected with various units of Union Carbide for more than thirty years, William E. Vogt has been elected secretary of Electro Metallurgical Sales Corp. and will be located at the general offices in New York. Mr. Vogt has been active for many years in the sale of ferroalloys and metals and other products of the company.

♦

Resignation of James E. Holmes, assistant sales manager of the Tubular division, Youngstown Sheet & Tube Co., Youngstown, O., has been announced.

♦

To replace P. E. Floyd, now serving with the government, W. G. McFadden has been named acting manager of Allegheny Ludlum's Chicago office.

♦

Formerly assistant general manager of sales, Organic Chemicals, Monsanto Chemical Co., New York, Victor E. Williams has been promoted to director of sales of this division, and will remain at his present location in New York. Frederick C. Renner, assistant general manager of sales of the same division, has been made general manager of sales, with offices in St. Louis.

♦

Wheelco Instruments Co. has appointed C. L. Clark as sales engineer for its Cleveland office. Mr. Clark was previously connected with Westinghouse Electric & Mfg. Co. Howard B. Jones has been placed in the Chicago office of the company as sales and service engineer.

♦

New York offices of The Allied Plastics Co. of Los Angeles, were recently opened in the Empire State building. Harry G. Long is in charge.

♦

Announcement has been made of the appointment of Frederick G. Dawson and Leonard C. Mallet as general manager and assistant general manager, respectively, for the new Kansas City, Mo. plant of United Aircraft Corp., East Hartford, Conn. Both men have been associated with the company thirteen years. The new plant will build Pratt & Whitney aircraft engines.

♦

After having been associated with Crucible Steel Co. for the past twenty years, William A. Harding has joined Jessop Steel Co., Washington, Pa. as manager of sheet, plate and specialties.

♦

Transfer of William Lester of the Chicago office of Celanese-Celluloid Corp. to the New York office to handle sales development has been announced.

♦

Organized to specialize in injection molding of thermosetting materials, Plastics Industries Inc., has opened a plant in Bedford, Ohio. C. D. Shaw who has been identified with the process for some time is with the company.

Meetings and Expositions

October 7-10—

Electrochemical Society Inc. Fall meeting to be held in Detroit. Colin G. Fink, 3000 Broadway, New York, is secretary.

October 9—

Gray Iron Founders' Society Inc. Annual meeting to be held at Hotel Cleveland, Cleveland. W. W. Rose, 1719 K street, Washington, D. C., is executive vice president.

October 12-14—

American Society of Mechanical Engineers. Fall meeting to be held at Hotel Sagamore, Rochester, N. Y. C. E. Davies, 29 West Thirty-ninth street, New York, is secretary.

October 12-16—

American Institute of Mining and Metallurgical Engineers. Annual meeting to be held at Statler hotel, Cleveland. Frank T. Sisco, 29 West Thirty-ninth street, New York, is secretary of the Metals Division.

October 12-16—

American Society for Metals. Twenty-fourth National Metal Congress and Exposition to be held at the Cleveland Public Auditorium, Cleveland. W. H. Eisenman, 7301 Euclid avenue, Cleveland, is secretary.

October 12-16—

American Welding Society. Annual meeting to be held at Hotel Cleveland, Cleveland. Miss M. M. Kelly, 33 West Thirty-ninth street, New York, is secretary.

October 12-16—

The Wire association. Annual meeting to be held at Carter hotel, Cleveland. Richard E. Brown, 300 Main street, Stamford, Conn., is secretary.

October 15-17—

American Gear Manufacturers association. Twenty-fifth semiannual meeting to be held at Skytop Lodge, Skytop, Pa. Newbold C. Goin, 301-2 Empire building, Pittsburgh, Pa., is manager-secretary.

October 16-17—

American Society of Tool Engineers Inc. Tenth semiannual meeting to be held at the Kemball hotel, Springfield, Mass. Clyde L. Hause, 3567 West Grand boulevard, Detroit, is national secretary.

October 26-30—

National Electrical Manufacturers association. Annual meeting to be held at the Waldorf-Astoria hotel, New York. W. J. Donald, 155 East Forty-fourth street, New York, is managing director.

October 27-29—

National Safety Council. Thirty-first annual meeting, the Sherman hotel, Chicago. N. H. Dearborn, 20 North Wacker drive, Chicago, is managing director.

November 16-18—

American Institute of Chemical Engineers. Thirty-fifth annual meeting to be held at the Netherland Plaza hotel, Cincinnati. S. L. Tyler, 50 East Forty-first street, New York, is executive secretary.

November 30-December 2—

American Society of Agricultural Engineers. Annual meeting to be held at Stevens hotel, Chicago. Raymond Olney, Box 229, St. Joseph, Mich., is secretary.

November 30-December 4—

American Society of Mechanical Engineers. Sixty-third annual meeting to be held at Hotel Astor, New York. C. E. Davies, 29 West Thirty-ninth street, New York, is secretary.

November 30-December 5—

Exposition of Power and Mechanical Engineering. Exposition to be held this year at new location, Madison Square Garden, New York. Charles F. Roth, 480 Lexington avenue, New York, is manager.

AS APPLIED TO A LIBBY TURRET LATHE

1 "LOGAN" Model 5022 Hydraulic Power Unit

2 "LOGAN" Reducing Valve

3 "LOGAN" Model "HR" Hydraulic Cylinder

4 "LOGAN" Model 4095 Control Valve

5 "LOGAN" 3-Jaw Chuck

This Libby Turret Lathe, manufactured by the International Machine Tool Corporation, is equipped with a "LOGAN" Hydraulic Power Unit as an entirely independent source of fluid power supply, which assures constant pressure for the continuous and efficient operation of the "LOGAN" Hydraulic Cylinder. A Rotating Type "LOGAN" Hydraulic Cylinder actuates a "LOGAN" 3-Jaw American Standard Chuck. For controlling the action of the hydraulic cylinder, a "LOGAN" 4095 Balanced Four Way Piston Type, Hand Operated Valve is used. "LOGAN" Representatives and "LOGAN" Engineers will be glad to make recommendations on your hydraulic problems.

LOGANSPORT MACHINE, INCORPORATED

911 PAYSON ROAD LOGANSPORT, INDIANA

Manufacturers of Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accessories

NEW MACHINES—
And the Companies Behind Them

(For illustrations of other outstanding machinery, see Pages 204-205)

Construction

Telescopic stacker, Lewis-Shepard Sales Corp., Watertown, Mass.
Alloy sprayer, Alloy-Sprayer Co., Detroit.

Finishing

*Mobile truck mixer, The T. L. Smith Co., Milwaukee.

Food

Milk bottle hooding machine, Package Machinery Co., Springfield. Mass.
Dried egg sifter, Great Western Mfg. Co., Leavenworth, Kans.
*All-metal cheese press, Damrow Bros. Co., Fond du Lac, Wis.

Heat Treating

Low-temperature metal chiller, Motor Products Corp., North Chicago, Ill.
*Flame-hardening machine, Hydraulic Machinery Inc., Detroit.

Industrial

Exhauster and ventilator, Chelsea Fan Blower Co., Irvington, N. J.
Combination picking belt and magnetic pulley separator, Stearns Magnetic Co., Milwaukee.

Instrument

Ball measuring anvils, George Scherr Co., New York.

Laboratory

Uniform temperature oven, Fisher Scientific Co., Pittsburgh.

Materials Handling

Electrically-operated lift truck, Barrett Cravens Co., Chicago.
Lift trucks, Lewis-Shepard Co., Watertown, Mass.
Hydraulic die handling and stacking truck, Lyon-Raymond Co., Greene, N. Y.

Metalworking

Balancer for marine reduction gears, Gisholt Machine Co., Madison, Wis.
25-ton hydraulic press, Hydraulic Machinery Inc., Detroit.
*Internal grinder, Sav-Way Tool & Machining Co., Detroit.
1300-ton forming press, Watson-Stillman Co., Roselle, N. J.
Tool and cutter grinder, Machinery Mfg. Co., Los Angeles.
Portable grinders, Skilsaw Inc., Chicago.
Milling machine for small parts, H. B. Rouse & Co., Chicago.
Supersensitive drill press, Edward Blake Co., Newton Centre, Mass.
Drilling machine, Snyder Tool & Engrg. Co., Detroit.
Hand screw machine, Logan Engineering Co., Chicago.
*Radial tapping machine, Bakewell Mfg. Co., Los Angeles.
*Gear finisher, Michigan Tool Co., Detroit.

Pumping

*Hydraulic 6-plunger horizontal pump, Charles F. Elmes Engrg. Works, Chicago.

Restaurant

Circulating and self-filtering deep fat fryer, The Hilliard Corp., Elmira, N. Y.
Continuous vegetable peeler, Food Machinery Co., Sprague-Sells Div., Hoopestown, Ill.

Rubber

Gyrating screens, Simplicity Engineering Co., Durand, Mich.

Textile

Pocket and edge folding machine, Koenig Steam Iron Mfg. Co., Philadelphia.
Slitting, rewinding, etc., machine, Johnstone Engineering & Machine Co., Downington, Pa.

Welding

Radial type spot welder, Sciaky Bros., Chicago.
*Square frame welder, Harnischfeger Corp., Milwaukee.

*Illustrated in pictorial spread, Pages 204-205.